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MANUAL
OF
BRITISH GRASSES.

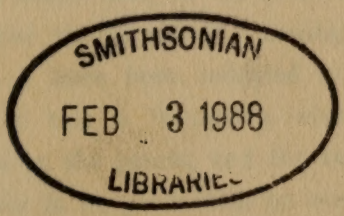
BY

W. J. GORDON,

AUTHOR OF "OUR COUNTRY'S FLOWERS," ETC.

WITH A COLOURED ILLUSTRATION OF EVERY SPECIES AND MANY ORIGINAL DIAGRAMS BY

J. T. GORDON.



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PREFACE.

THE word grasses is used in this book in its strictest sense and not as a farmer would use it as including the clovers and other forage plants, nor in its original meaning of common herbage as in the Bible; and consequently several grasses, popularly so called, do not appear herein as they do not belong to the Gramineæ. The order, in which all the true grasses are grouped, contains about 3,600 species, and of these we deal with the hundred or so said to be native to our islands for the usual reason that the dates of their introduction are unknown. Some may have arrived during the historic period, some may have originated here, but none are confined to our area; in which there is nothing remarkable considering the ease and frequency with which grass seeds are distributed.

For its food plants no botanical order is of greater interest nor has any been more written about, some of the books being really wonderful for the labour they involved. Among the many, for instance, to which I have been indebted in the verification of the materials of this is Hanham's, which is illustrated by actual specimens of the plants, and the author naïvely apologises for the delay in its production on account of the difficulty in selecting 60,000 suitable examples from the mass of his collection! Only those who have had to deal with

a collection of their own can adequately realise the task he set himself. And such collectors are increasing in number, owing to the economic importance of the subject, helped by the grasses remaining as plentiful as ever while other wild flowers become scarcer every year.

That the species may be quickly distinguished, a somewhat similar plan has been adopted to that in " Our Country's Flowers," the name of the plant being found by the shortest method that could be devised—though it may hold good for the British group alone—the identification being confirmed by the detailed description. Hence more attention than usual is given to the vegetative and other external characters.

The illustrations have all been specially drawn for the work by my son. They include a complete series of a hundred and one coloured figures of the plants, and over eighty diagrams of the structure of their flowers.

W. J. G.

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CHAPTER I.

INTRODUCTORY.

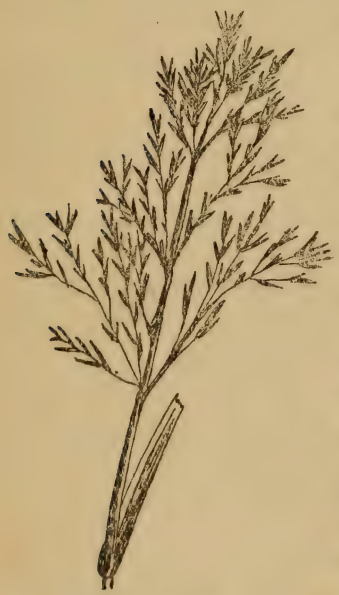
WE will begin by taking a grass in bloom and arriving at its name as quickly as we can. Perhaps, however, our specimen is not a grass but a sedge, and we may as well get over that difficulty at once. The stem of a sedge is always solid and generally triangular; that of a grass is generally hollow, rounded, and never three-sided. The leaves of a sedge are in three ranks; those of a grass are alternate in two ranks. In both, the leaves embrace the stem with sheaths, but in grasses the sheaths are nearly always split, while in sedges they are not. Further, where the leaf-blade joins the sheath in grasses the inner side of the sheath is more or less prolonged into a sort of membranous edging known as the ligule, whereas a sedge has no ligule.

There are other distinctions we may deal with later on, but we have enough to make sure that we have a grass and not a sedge; for the stem is round and hollow, the leaves are alternate in two series, the sheath is split and there is an unmistakable ligule.

How about the inflorescence, that is the arrangement of the flowers on the stem? Is it a spike, that is having the flowers attached to the axis without a pedicel or stalk to each; is it a raceme in which the pedicels are the primary branches; or is it a panicle in which the flowers grow on the secondary or remoter branches? For our present purpose we need not trouble ourselves regarding the raceme, and we can assume that what looks like a spike is really a spike, though closer inspection may show it not to be strictly within the definition. Dealing with them in this off-hand way, we shall find that there is no difficulty in

sorting out the inflorescences of all our British grasses into either spikes or panicles. Let us agree then that it is a panicle, as it undoubtedly is in the very strictest sense.

Having advanced so far we will eliminate a few exceptions from the group. Is the sheath quadrangular and not split? No. Then its genus is not *Melica*. Is the sheath white with red veins? No. Then it is not *Holcus*. Are the leaves glaucous above and dark green underneath? No. Then it is not *Triodia*. Is the stem solid and bent at the only node? No. Then it is not *Molinia*. Are its spikelets orbicular?



PANICLE.

But what is a spikelet? That which is often called the flower of the grass, consisting of a pair of bracts known as glumes, which enclose one or more flowers, better called florets, placed on an axis (rachilla) one above the other alternately, each floret being, typically, enclosed in another pair of bracts of its own.

It would have saved obscurity in many botanical descriptions of the grasses if each of these four bracts, the lower pair and the upper pair, had been given a special name. Even the old plan of calling the upper pair glumellæ was better than the prevailing fashion in which the higher of the upper pair is the palea, the next the flowering glume or fruiting glume, and the lower pair the glumes, with inevitable references to the upper glume and the lower glume and a consequent doubt as to whether barren glume or flowering glume is meant. To avoid trouble of this sort, the lower pair have in this book been spoken of as glumes and the upper pair as paleæ, the lower glume being called the outer glume, the upper the inner glume. The lower palea (that

is the flowering glume) being the outer palea and the upper of the pair the inner palea.

The beginner finds the flowers of the grasses rather awkward to deal with at first, as they are too small for the ordinary magnifying glass and too large for the microscope. The best aid is afforded by a dissecting microscope of low power, but a glass answers every purpose if magnifying rather more than the usual run of such things. Anyhow a lens of some sort is essential, though in this particular case we can see without it that the spikelet is not orbicular—wherefore the genus is not *Briza*—and further that it has glumes, and consequently cannot be *Leersia*.

Without the glass, too, but better with it, we can see that each spikelet has but one floret. And that helps us much, for we have only to feel the leaves whether they be smooth or rough, and finding them smooth and broad we know the genus to be *Milium* without further ceremony. As there is only one species of *Milium* in the British flora, the grass must be *M. effusum*, the Spreading Millet, as we might have guessed from its height and from our meeting with it in our walk through the woods.

Spike.

Let us, however, with the aid of the glass, open up this spikelet and compare it with a diagram in which the typical arrangement of the florets is shown. Lowest of all we have the outer glume, slightly above and opposite to it is the inner glume. Higher up the rachilla is the outer palea with the inner palea opposite. Within the paleæ more or less we have the pistil with the lodicules—in this case two—at the base, and round it is the whorl of three stamens, the first placed just above the outer palea, and often rather larger than the others, each stamen with a longish filament carrying the double notched anther. In one British genus, *Anthoxanthum*, there are only two stamens; in some genera, all foreign, there

may be only one, as in *Cinna*, or six, as in *Oryza*, or even thirty, as in *Ochlandra*.

The pistil contains a single ovary with a single ovule and carries two styles on which are the stigmas, feathery (plumose) in form as affording a large catchment surface for the pollen shed by the adjoining anthers or carried by the wind from anthers of other flowers. Sometimes, as in *Nardus*, there is but

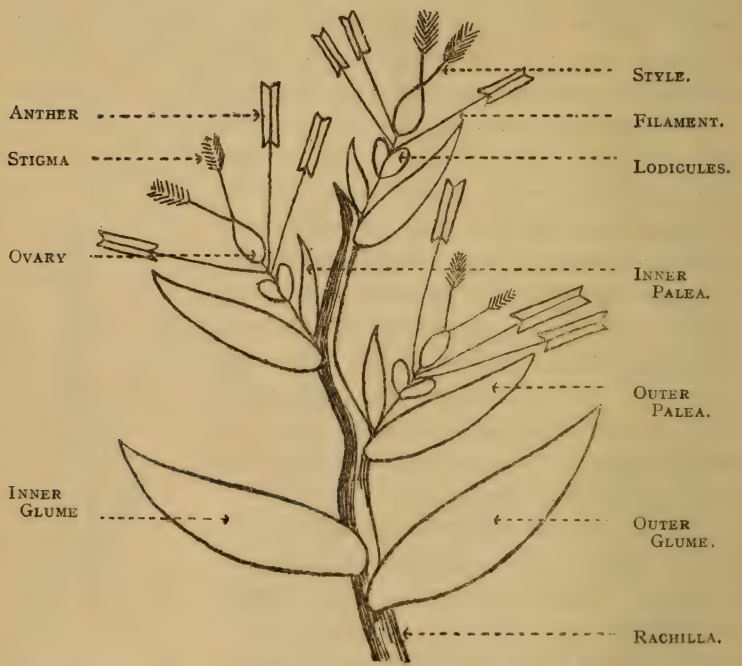


Diagram of Spikelet.

one style ; sometimes there are three, as in *Megalachne* of Juan Fernandez ; sometimes, as in *Briza*, there is a rudimentary third.

Let us take another panicle. Finding that the grass is not one of the six already mentioned (*Melica*, *Molinia*, etc.), we count the florets in the spikelet and find that there are three or more, and that they bear awns, these being the stiff bristles which in cereals form the beard. If there had been only two florets, both complete, the genus would be *Aira* ; if two with the lower without

any pistil, it would be *Arrhenatherum*. But it has several florets. Then if the panicle be tufted it can only be *Dactylis* (Cocksfoot); but it is gracefully diffuse, and we can tell it by its awn. Is the awn terminal, that is, does it start from the apex of the outer palea? No. Then it is not *Festuca*. Does it start from just below the apex, that is, is it sub-terminal? No. Then it is not *Bromus*. Is it dorsal, that is, does it start from the back? Yes. Then it is *Avena*. But which species? Are the spikelets erect and the ligule truncate, that is, cut off short? No. Then it is not the Yellow Oat. Are the spikelets erect and the ligule pointed? No; the spikelets droop, the ligule is short, and the species is the Wild Oat, *A. fatua*.

Now let us take a spike. Is it digitate, that is, is it a group of spikes, diverging like fingers? No. Are the spikelets placed in little cavities or notches in the stem? Yes. Are they in ones, twos, or threes? Threes. Then the genus is *Hordeum*. If they had been in pairs, it would have been *Elymus*; if in ones, either *Nardus*, *Lepturus* *Agropyrum*, or *Lolium*. The one style (instead of two) distinguishes *Nardus*; the axis jointed at each notch marks off *Lepturus*; the spikelets close together characterise *Agropyrum*, as the spikelets with well-marked intervals between indicate *Lolium*.

Next we will have a spike in which the spikelets are not in notches. Are the spikelets on one side only? No. Then the genus is neither *Cynosurus* in which the spikelets are rounded, nor *Spartina* in which they are flattened. Are the spikelets alternate in two opposite rows? No. Is the spike ovoid, that is, almost globular? No. Then it is neither *Phalaris* nor *Lagurus*. Does the spike taper from the base upwards? No. Is it fusiform, that is, spindle-shaped, or cylindrical? Yes, probably cylindrical. Let us make sure. Is the ligule very long and cleft into two, that is bifid? No. Then it is not *Psamma*. Is the spike interrupted near the base. No. Then it is not *Koeleria*. Is the base of the leaf auricled, that is, has it rounded ears; and are there only two anthers? No. Then it is not *Anthoxanthum* Are the spikelets imbricated, that is do they overlap one another like the tiles on a house? No. Then it is not *Sesleria*. Is the

spike silky? No, it is bristly. Then it is not *Alopecurus* (Foxtail). Are the spikelets compressed laterally or dorsally? Laterally. Then it is *Phleum*, and probably our old friend Timothy, which we can easily ascertain by a reference to our tabular arrangement of that genus. The spike is long and cylindrical; the glumes are neither wedge-shaped nor tapering, they are truncate, and with that and the thin, white ligule toothed at the apex, *Phleum pratense*, otherwise Timothy, is unmistakably indicated.

We need not identify at length every genus in the list. We have had examples enough to show the working of the key which it is time to give.

Spikes digitate.
Spikelets in ones. *Cynodon.*
Spikelets in pairs. *Panicum* (as regards *P. sanguinale* and *P. glabrum*, frequently grouped into *Digitaria*).

Spikes not digitate.
Spikelets in notches.
Spikelets in ones.
Spikelets on one side only but in 2 alternate rows.
Only one style. *Nardus.*
Axis jointed at each notch. *Lepturus.*
Spikelets close. *Agropyrum.*
Spikelets distant. *Lolium.*
Spikelets in pairs. *Elymus.*
Spikelets in threes. *Hordeum.*
Spikelets not in notches.
Spikelets on one side only.
Spikelets flattened. *Spartina.*
Spikelets not flattened. *Cynosurus.*
Spikelets alternate in 2 opposite rows.
Leaves channelled and blunt. *Mibora.*
Leaves flat and acute. *Festuca* (as regards *F. loliacea*).
Spikelets turning to one side. *Poa* (as regards *P. loliacea*).

Spike ovoid, almost globular.
Spike smooth. *Phalaris.*
Spike with long, silky hairs. *Lagurus.*

Spike tapering from base.
Spikelets flattened. *Polypogon.*
Spikelets not flattened. *Gastridium.*

Spike fusiform or cylindrical.
Ligule lengthy and bifid. *Psamma.*
Ligule not lengthy and bifid.
Spike interrupted near base. *Koeleria.*
Spike regular.
Leaf base with rounded ears (anthers 2). *Anthoxanthum.*
Spikelets imbricated, colour bluish. *Sesleria.*
Spike silky. *Alopecurus.*
Spike bristly.
Spikelets compressed laterally. *Phleum.*
Spikelets compressed dorsally. *Panicum* (as regards *P. verticillatum*, *P. glaucum*, and *P. viride*, frequently grouped into *Setaria*).

Spikes compound.
Spikelets on one side only
Panicum (as regards *P. crus-galli*, frequently assigned to *Echinochloa*).

Spikelets on both sides. *Brachypodium.*

Panicles.
Glumes absent. *Leersia.*
Sheath quadrangular and not split. *Melica.*
Sheath white with red veins. *Holcus.*
Stem solid and bent at the only node. *Molinia.*
Spikelets orbicular. *Briza.*
Leaves glaucous above, dark green below. *Triodia.*
Spikelets with one floret.
Leaves smooth and broad. *Milium.*
Leaves rough.

Hairs numerous, long, silky.
Leaves broad and light green; nodes purple. *Digraphis*.
Leaves narrow and green; nodes green. *Calamagrostis*.
Hairs few and short. *Agrostis*.

Spikelets with 2 or more florets.
Awned.
Florets 2, both perfect. *Aira*.
Florets 2, lower imperfect. *Arrhenatherum*.
Florets 3 or more.
Panicle tufted. *Dactylis*.
Panicle diffuse.
Awn dorsal. *Avena*.
Awn sub-terminal; style sub-terminal. *Bromus*.
Awn terminal; style terminal. *Festuca*.

Awnless.
Florets enveloped in silky hairs of axis. *Arundo*.
Glumes 6, leaf and sheath netted. *Hierochlæ*.
Glumes 2, truncate. *Catabrosa*.
Glumes 2, short, obtuse or pointed. *Poa*.
Glumes 2, long and lanceolate. *Festuca* (as regards *F. ovina* and *F. elatior*).

Though this key has been found to work satisfactorily at every trial, it is as well to be able to identify our grasses in a more orthodox manner. Let us then take another specimen and trace it to its species in the usual way.

To do this we must begin by referring to our fifth chapter, wherein the distinctions between the thirteen tribes of grasses are given in tabular form. Comparing our specimen with the first analysis, we find that:

1. It does not belong to the Bamboos, as its stem is not woody and its leaves are not joined to their sheaths by a petiole, that is a leaf-stalk.

2. Having more than two florets in the spikelet it does not belong to the Maydeæ, Andropogoneæ, Zoysieæ, Tristegineæ, Paniceæ, or Oryzeæ.

3. Not having four glumes it is not one of the Phalarideæ.

4. Having more than one floret it does not belong to the Agrostideæ.

5. As the spikelets are not in rows it cannot be one of the Chlorideæ or Hordeæ.

6. It must consequently belong to either the Aveneæ or Festuceæ.

7. The glumes not being longer than the outer palea and there being no dorsal awn, it must belong to the Festuceæ.

Our second key helps us to find the tribe more quickly. The two glumes at once rule it out of three tribes. The " more florets than one " eliminate the Agrostideæ. Its panicle takes it on to Aveneæ and Festuceæ, where again the absence of the dorsal awn, etc., reduce it to the " spikelets otherwise " of the Festuceæ, a position which is confirmed when we read the description of the tribe.

In the chapter on The Tribes and their Genera (VI.) we refer to the tabular arrangement of the Festuceæ, where the panicle enables us to pass four genera and land in " panicle diffuse, awn of outer palea terminal, style terminal " of *Festuca;* and we verify the identification by reference to the description of that genus, and the diagram of the floret on which the parts are shown greatly magnified and opened out. Reference in a similar way to the seventh chapter enables us to readily recognise the species as *Festuca ovina* and verify our diagnosis by the description and the drawing of the spikelet. Sheep's Fescue is a very small grass, and if we can deal with its diminutive parts in this way we shall have little difficulty with any other.

It may be asked what is a tribe ? And perhaps—though it would seem to be hardly necessary—it should be said that an order is frequently divided into tribes, these being merely assemblages of genera, the genera consisting of species, the species in

some cases being further marked off into varieties, which some consider valid and some do not, while others hold that several such varieties are permanent and distinct enough in their characters to be of specific rank. Hence there is no generally accepted list of British grasses. Bentham, for instance, has 101 species, Babington 127.

In this book we have followed Bentham, for the following reason. It is much better for anyone to compare specimens with actual plants, and the most accessible collection of our native grasses is in one of the swing cases in the Botanical Gallery at the Natural History Museum at South Kensington, which anyone at any time can see without having to ask for permission. In this, as in many other collections, the plants are arranged in Bentham's way, with Bentham's descriptions affixed, and the advantage to the beginner of following the same system with the specimens available was too obvious to be disregarded.

In one small matter we have not followed Bentham or others, and that is in the spelling of some of the specific names with a capital. Throughout we have used a capital only for genera, as is now the custom in zoology, where the absence of the capital from the beginning of a name proclaims at once we are dealing with a species and not with a genus. The spelling of specific names with a capital is merely a printer's custom which it is time should become as obsolete in botany as in the sister natural science.

Attempts have been made to identify our grasses by their vegetative characters alone, but though some can be recognised in that way, many cannot; and owing to these exceptions the attempt has failed in every scheme we have tried. We may know a few grasses, but we cannot fit our knowledge into a key that will serve for the group. We may, however, help on the attainment of this very desirable object by making our descriptions of such characters as full as possible, and that we have done in our seventh chapter.

CHAPTER II.

LIST OF BRITISH GRASSES.

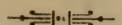


Plate I.

1. Cut Grass.
   Leersia oryzoides.
   Syn.: Homalocenchrus oryzoides.
2. Spreading Millet.
   Milium effusum.

Plate II.

3. Finger Grass:
   Panicum sanguinale.
   Syn.: Digitaria sanguinalis.
4. Glabrous Finger Grass.
   Panicum glabrum.
   Syn.: Digitaria humifusa.
5. Rough Bristle Grass.
   Panicum verticillatum.
   Syn.: Setaria verticillata.

Plate III.

6. Glaucous Bristle Grass.
   Panicum glaucum.
   Syn.: Setaria glauca.
7. Green Bristle Grass.
   Panicum viride.
   Syn.: Setaria viridis.
8. Cockspur.
   Panicum crus-galli.
   Syn.: Echinochloa crus-galli.

Plate IV.

9. Northern Holy Grass.
   Hierochloa borealis.

10. Vernal Grass.
    Anthoxanthum odoratum.

11. Canary Grass.
    Phalaris canariensis.

12. Reed Grass.
    Digraphis arundinacea.
    Syn.: Phalaris arundinacea.

Plate V.

13. Timothy.
    Phleum pratense.

14. Alpine Cat's-tail.
    Phleum alpinum.

Plate VI.

15. Purple-stalked Cat's-tail.
    Phleum boehmeri.

16. Rough Cat's-tail.
    Phleum asperum.

17. Seaside Cat's-tail.
    Phleum arenarium.

Plate VII.

18. Slender Foxtail.
    Alopecurus agrestis.

19. Meadow Foxtail.
    Alopecurus pratensis.

20. Marsh Foxtail.
    Alopecurus geniculatus.

21. Alpine Foxtail.
    Alopecurus alpinus.

Plate VIII.

22. KNAPPIA.
Mibora verna.

23. HARE'S-TAIL.
Lagurus ovatus.

24. ANNUAL BEARD GRASS.
Polypogon monspeliensis.

25. PERENNIAL BEARD GRASS.
Polypogon littoralis.

Plate IX.

26. FIORIN.
Agrostis alba.

27. BENT GRASS.
Agrostis canina.

28. BRISTLE BENT.
Agrostis setacea.

29. SILKY BENT.
Agrostis spica-venti.
Syn.: Apera spica-venti.

Plate X.

30. NIT GRASS.
Gastridium lendigerum.
Syn.: Gastridium australe.

31. MARRAM.
Psamma arenaria.
Syn.: Ammophila arenaria.

Plate XI.

32. WOOD SMALLREED.
Calamagrostis epigeios.
Syn.: Arundo epigejos.

33. PURPLE SMALLREED.
Calamagrostis lanceolata.
Syn.: Arundo calamagrostis.

Plate XI.—(*continued*).

34. Narrow Smallreed.
Calamagrostis stricta.
Syn.: Arundo stricta.

35. Meagre Smallreed.
Calamagrostis strigosa.
Syn.: Arundo strigosa.

Plate XII.

36. Tufted Hair Grass.
Aira cæspitosa.

37. Wavy Hair Grass.
Aira flexuosa.

Plate XIII.

38. Grey Hair Grass.
Aira canescens.
Syn.: Weingaertneria canescens.
Corynephorus canescens.

39. Early Hair Grass.
Aira praecox.

40. Hair Grass.
Aira caryophyllea.

Plate XIV.

41. Wild Oat.
Avena fatua.

42. Perennial Oat.
Avena pratensis.

43. Yellow Oat.
Avena flavescens.
Syn.: Trisetum pratense.

Plate XV.

44. False Oat.
Arrhenatherum avenaceum.

45. Woolly Soft Grass.
Holcus lanatus.

46. Soft Grass.
Holcus mollis.

47. Dog's-tooth.
Cynodon dactylon.
Syn.: Capriola dactylon

Plate XVI.

48. Cord Grass.
Spartina stricta.

49. Hard Grass.
Lepturus incurvatus.

50. Mat Grass.
Nardus stricta.

51. Lyme Grass.
Elymus arenarius.

Plate XVII.

52. Wood Barley.
Hordeum sylvaticum.

53. Meadow Barley.
Hordeum pratense.

54. Wall Barley.
Hordeum murinum.

55. Squirrel-tail.
Hordeum maritimum.

Plate XVIII.

56. Couch.
Agropyrum repens.
Syn.: Triticum repens.

57. Bearded Wheat Grass.
Agropyrum caninum.
Syn.: Triticum caninum.

58. Rye Grass.
Lolium perenne.

59. Darnel.
Lolium temulentum.

Plate XIX.

60. Slender False Brome.
Brachypodium sylvaticum.

61. Heath False Brome.
Brachypodium pinnatum.

Plate XX.

62. Upright Brome.
Bromus erectus.

63. Hairy Brome.
Bromus asper.
Syn.: Bromus ramosus.

64. Barren Brome.
Bromus sterilis.

65. Great Brome.
Bromus maximus.

Plate XXI.

66. Compact Brome.
Bromus madritensis.

67. Field Brome.
Bromus arvensis.
Syn.: Serrafalcus arvensis.

Plate XXI.—(*continued*).

68 TALL BROME.
Bromus giganteus.
Syn.: Festuca gigantea.

Plate XXII.

69. SHEEP'S FESCUE.
Festuca ovina.

70. MEADOW FESCUE.
Festuca elatior.
Syn.: Festuca pratensis.

Plate XXIII.

71. REED FESCUE.
Festuca sylvatica.

72. RAT'S-TAIL FESCUE.
Festuca myurus.

73. SINGLE-GLUMED FESCUE.
Festuca uniglumis.

Plate XXIV.

74. COCK'S-FOOT.
Dactylis glomerata.

75. CRESTED DOG'S-TAIL.
Cynosurus cristatus.

76 ROUGH DOG'S-TAIL.
Cynosurus echinatus.

Plate XXV

77 QUAKE GRASS.
Briza media.

78. LESSER QUAKE GRASS.
Briza minor.

Plate XXVI.

79. Reed Meadow Grass.
Poa aquatica.
Syn.: Glyceria aquatica.

80. Manna Croup.
Poa fluitans.
Syn.: Glyceria fluitans.

81. Sea Meadow Grass.
Poa maritima.

Plate XXVII.

82. Reflexed Meadow Grass.
Poa distans.

83. Procumbent Meadow Grass.
Poa procumbens.

84. Hard Meadow Grass.
Poa rigida.

Plate XXVIII.

85. Darnel Meadow Grass.
Poa loliacea.

86. Annual Meadow Grass.
Poa annua.

87. Flat Meadow Grass.
Poa compressa.

Plate XXIX.

88. Smooth-stalked Meadow Grass.
Poa pratensis.

89. Rough-stalked Meadow Grass.
Poa trivialis.

90. Wood Meadow Grass.
Poa nemoralis.

Plate XXX.

91. Wavy Meadow Grass.
Poa laxa.

92. Alpine Meadow Grass.
Poa alpina.

93. Bulbous Meadow Grass.
Poa bulbosa.

Plate XXXI.

94. Whorl Grass.
Catabrosa aquatica.

95. Flying Bent.
Molinia cærulea.

Plate XXXII.

96. Mountain Melic.
Melica nutans.

97. Wood Melic.
Melica uniflora.

98. Heath Grass.
Triodia decumbens.
Syn.: Sieglingia decumbens.

Plate XXXIII.

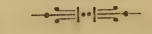
99. Crested Koeleria.
Koeleria cristata.

100. Blue Moor Grass.
Sesleria cærulea.

101. Reed.
Arundo phragmites.
Syn.: Phragmites communis.

CHAPTER III.

CUSTOMARY NAMES.



In the foregoing list we have given what seems to be the English name by which each species is mostly known; but there are many other names, some of them very local, some in such wide use that mention should be made of them. In some cases different species have the same name. We have no space for a complete list, if it were possible to compile one, but the following will be found to contain nearly all the current names and many only rarely met with. The numbers are as before, and include varieties.

1.
Asperella
Cut Grass
Rice Grass

2.
Millet
Spreading Mille
Wood Millet

3.
Crab Grass
Finger Grass
Fingered Panic

4.
Glabrous Finger Grass
Glabrous Panic

5.
Reflex Bristle Grass
Rough Bristle Grass
Rough Panic

6.
Glaucous Bristle Grass
Glaucous Panic

7.
Green Bristle Grass
Green Panic

8.
Cockspur
Cockspur Panic
Loose Panic

9.
Northern Holy Grass

10.
Spring Grass
Vernal Grass

11.
Canary Grass
Painted Lady Grass

1
2

PLATE II.

6
8
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PLATE IV.

13
14

PLATE VI.

18
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PLATE VIII.

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PLATE X.

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PLATE XII.

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PLATE XIV.

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PLATE XVI.

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PLATE XVIII.

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PLATE XX.

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67
68

PLATE XXII.

71
72
73

PLATE XXIV.

77
78

PLATE XXVI.

84
82
83

PLATE XXVIII.

89
90
88

PLATE XXX.

94

95

PLATE XXXII.

12.
Bride's Laces
Gardener's Garters
Painted Lady Grass
Reed Grass
Riband Grass

13.
Cat's-tail
Meadow Phleum
Timothy

14.
Alpine Cat's-tail
Alpine Phleum

15.
Boehmer's Phleum
Purple-stalked Cat's-tail

16.
File Cat's-tail
Rough Cat's-tail

17.
Sand Cat's-tail
Seaside Cat's-tail

18.
Black Grass
Mousetail
Slender Foxtail

19.
Meadow Foxtail

20.
Marsh Foxtail
Orange-spiked Foxtail
Floating Foxtail
Kneed Water Grass

21.
Alpine Foxtail

22.
Knappia
Mibora

23.
Hare's-tail

24.
Annual Beard Grass

25.
Perennial Beard Grass

26.
Black Couch
Black Squitch
Fine Bent
Fiorin
Marsh Bent
Purple Bent

27.
Bent Grass
Brown Bent
Winter Fog

28.
Bristle Agrostis
Bristle Bent
Deer's-foot
Rabbit Grass

29.
Silky Agrostis
Silky Bent
Wind Grass

30.
Nit Grass
Panic Millet

31.
Helme
Marram
Murran
Sea Bent
Sea Matweed
Sea Reed
Spire

32.
Small Close Reed
Wood Reed
Wood Smallreed

33.
Purple Smallreed

34.
Narrow Smallreed

35.
Meagre Smallreed

36.
Tufted Aira
Tufted Bent
Tufted Hair Grass
Turfy Hair Grass
Tussock

37.
Bog Hair Grass
Wavy Aira
Wavy Bent
Wavy Hair Grass

38.
Club Grass
Grey Aira
Grey Bent
Grey Hair Grass

39.
Early Aira
Early Bent
Early Hair Grass

40.
Hair Grass

41.
Havers
Wild Oat

42.
Narrow-leaved Perennial Oat
Perennial Oat

43.
Yellow Oat

44.
Andes Grass
False Oat
French Rye
Fromental
Onion Couch
Tall Oat

45.
Woolly Soft Grass
Yorkshire Fog

46.
Creeping Soft Grass
Soft Grass
Soft Holcus
Wick

47.
Bermuda Grass
Creeping Cynodon
Dog's-tooth

48.
Cord Grass
Twin-spiked Cord Grass

49.
Curved Lepturu
Hard Grass

50.
Mat Grass
Moor Mat Grass
Small Matweed.

51.
Lyme Grass
Starr

52.
Wood Barley

53.
Meadow Barley

54.
Mouse Barley
Wall Barley
Way Bennet

55.
Sea Barley
Squirrel-tail

56.
Couch
Quitch Grass
Spear Grass
Twitch
Whickens
Wood Couch

57.
Bearded Wheat Grass
Dog's Wheat
Fibrous Wheat Grass
Wood Couch

58.
Devon Eaver
Eaver
Evergreen Rye Grass
Perennial Darnel
Ray Grass
Red Darnel
Rye Grass

59.
Bearded Darnel
Bearded Rye
Cheat
Darnel
Neele
White Darnel

60.
Slender False Brome
Tor Grass

61.
Heath False Brome

62.
Upright Brome
Upright Oat Grass

63.
Hairy Brome

64.
Barren Brome
Drank

65.
Great Brome

66.
Compact Brome

67.
Field Brome
Lob Grass
Taper Field Brome

68.
Tall Brome

69.
Red Fescue
Sheep's Fescue

70.
Evergreen Grass
Meadow Fescue
Spiked Fescue
Randall Grass

71.
Reed Fescue

72.
Rat's-tail Fescue
Squirrel-tail Fescue

73.
One-glumed Fescue
Single-glumed Fescue

74.
Cock's-foot
Orchard Grass
Rough Cock's-foot

75.
Crested Dog's-tail

76.
Rough Dog's-tail
Tough Dog's-tail

77.
Lady's Hair
Maiden Hair
Quake Grass
Quakers
Quaking Grass
Rattle Grass
Totter Grass
Wagwant
Cow Quakes

78.
Lesser Quake Grass
Lesser Quakers

79.
Reed Meadow Grass
Reed Sweet Grass
White Lead

80.
Floating Meadow Grass
Floating Poa
Floating Sweet Grass
Manna Croup
Manna Grass

81
Creeping Sea Meadow Grass
Sea Meadow Grass
Sea Poa

82.
Reflexed Meadow Gras
Reflexed Poa

83.
Procumpent Meadow Grass
Procumbent Poa

84.
Hard Meadow Grass
Hard Poa

85.
Darnel Poa
Darnel Meadow Grass
Dwarf Wheat Meadow Grass

86.
Annual Meadow Grass
Annual Poa
Suffolk Grass

87.
Flat Meadow Grass
Flat-stemmed Meadow Grass
Flattened Meadow Grass
Flattened Poa

88.
Blue Grass
Meadow Poa
Smooth-stalked Meadow Grass

89.
Bird Grass
Fowl Grass
Orcheston Grass
Roughish Meadow Grass
Rough Poa
Rough-stalked Meadow Grass

90.
Evergreen Meadow Grass
Wood Meadow Grass
Wood Poa

91.
Wavy Meadow Grass
Wavy Poa

92.
Alpine Meadow Grass
Alpine Poa

93.
Bulbous Meadow Grass
Bulbous Poa

94.
Catabrose
Water Hair Grass
Water Whorl Grass
Whorl Grass

95.
Flying Bent
Lavender Grass
Purple Melic

96.
Mountain Melic

97.
Melic
Wood Melic

98.
Heath Grass

99.
Crested Hair Grass
Crested Koeleria

100
Blue Moor Grass

101.
Common Reed
Reed

CHAPTER IV.

BRITISH CEREALS.

NO book on grasses would be complete without a few notes on our cereals. None of them is included in our flora, though all the best varieties are sports discovered away from the fields or as individuals in an ordinary crop and undoubtedly of British origin ; but being unknown to us except under cultivation we cannot consider them as wild. They are only four in number, and owing to the large size of their flowers and fruit afford us the best examples for studying the structure of the Gramineæ.

Unlike grasses which rarely thrive except in company and are sown broadcast, the cereals are always distinguishable by the uniformity of the crop ; and with such a compact group we have no difficulty in identifying them by their vegetative as well as their floral characters.

To begin with, we can recognise them by their seeds. In all four the grain is grooved, but in two, Oats and Rye, it is of slender build, though some Oats are coniform and some oviform. In Oats the grain is adherent, whereas in Rye it is free. In both it is hairy at the apex, but in Oats it is occasionally hairy all over. In Rye there is no epiblast, but in Oats this is always present, though not conspicuous. Finally when we make a thin section for the microscope we find that in Oats the starch grains are compound, while in Rye they are simple as in Wheat and Barley which may be distinguished from each other as follows : First by sheir shape, Wheat being slightly compressed laterally and not so broad as Barley ; secondly, by the Wheat grain being free, while that of Barley is adherent ; thirdly by the epiblast being

absent in Barley and present in Wheat, though it requires looking for.

Let us put these distinctions in another way :

Oats. Grain generally slender, deeply grooved, adherent, hairy all over or only at apex ; epiblast small and inconspicuous ; starch grains compound.

Rye. Grain slender, deeply grooved, compressed laterally, free, hairy at apex ; epiblast absent ; starch grains simple.

Wheat. Grain stout, deeply grooved, slightly compressed laterally, free, hairy at apex ; epiblast small and inconspicuous ; starch grains simple.

Barley. Grain stout, deeply grooved, adherent, hairy at apex ; epiblast absent ; starch grains simple.

When the grain germinates we have another means of identification. In Wheat and Rye the plumule will be found to emerge close to the roots of the embryo ; in Barley and Oats it makes its way outwards from the other end of the grain. Thus we have two groups of two each ; and the members of each group are as readily distinguishable, for in Wheat the roots are three in number, in Rye there are four ; in Oats there are three, in Barley five or six.

Putting this as plainly as possible, we have :

Plumule emerging remote from roots of embryo.
Roots five or six, *Barley*.
Roots three, *Oats*.
Plumule emerging close to roots of embryo.
Roots three, *Wheat*.
Roots four, *Rye*.

But it will be asked what is the plumule ? And in answering this we will deal with a few more points to which the germination of the seed in its early stage calls attention.

The back of the grain is grooved, the groove facing the inner palea when on the plant. Looking down the groove near the base you will see a narrow scar ; that is the hilum, which is the scar left when the grain separated from the placenta. There

being no funiculus, or stalk, the hilum indicates the position of the micropyle, the ovary being what is known as hemitropous, that is half inverted. Sometimes the hilum is round, sometimes, as in this case, it is long, but so strictly does it maintain its shape through whole groups of genera, that it has its uses in classification.

On the opposite side, that facing the outer palea on the plant, is the embryo. This is near the base of the grain and is visible through the pericarp, as the outer covering is called, coating which on the inside is the aleurone layer. The grain is as a rule a caryopsis, that is a dry fruit, or nut, in which the seed instead of being free, as in an achene, is joined to the outer covering, the other contents being the endosperm, or nutriment of the embryo, which forms the bulk of the grain, and, when ground, is known to us as flour. In some grasses, none of them British, the seed is loose and in due time falls out ; and in two or three genera of the Bambusæ the fruit is a berry, which in one species, *Melocanna bambusoides*, may be from four to six inches in diameter.

Backing against the endosperm is the scutellum, through which its absorption is effected, and in front of the scutellum are the embryo with the plumule, or bud of embryonic leaves, by which the plant rises above the ground, and the radicle from which the roots come. In front of these, up against the pericarp, is, when present, the small scale known as the epiblast. The plumule is on a, sometimes indistinct, stem known as the epicotyl ; and the radicle is enclosed in a sheath, the coleorhiza, which the roots burst through as soon as they begin to grow.

Some authorities consider the scutellum to be the cotyledon ; others say that the scutellum and first sheathing leaf form the cotyledon ; a few tell us that the epiblast represents a second cotyledon, a rather awkward suggestion, as it might make our plant a dicotyledon.

When growth begins the radicle gives forth the primary root soon followed by the adventitious roots ; and the plumule, by the shortest way, as in Rye and Wheat, or by the longest, as in Oats and Barley, emerges from the grain, and, as a pencil of rolled leaves, known as the spear, pushes its hard point in a

spiral advance up through the soil into the air. And as soon as the seedlings are fairly developed we can recognise them as follows :

Leaves rolled to the right.
Ribs thirteen or fewer.
Sheath glabrous.
Embryo with three roots. *Oats.*
Leaves rolled to the left.
Ribs thirteen or fewer.
Sheath hairy. Leaves green.
Ligule long.
Embryo with three roots. *Wheat*
Sheath hairy. Leaves reddish.
Ligule short.
Embryo with four roots. *Rye.*
Ribs eighteen or more.
Sheath glabrous.
Embryo with five or six roots. *Barley.*

This looks clear enough, and instead of occupying space with further explanation we can pass on to the next stage, when the seedlings have become sturdy young plants with their leaves fully developed. In this state we can again recognise the growing crop without waiting for the flowers.

Leaves auricled.
Auricle large. Ribs eighteen to twenty-four. *Barley.*
Auricle medium. Ribs eleven to thirteen.
Sheath hairs short. *Wheat.*
Auricle small. Ribs eleven to thirteen.
Sheath hairs long and short intermixed. *Rye.*
Leaves not auricled. *Oats.*

In time the flowers begin to form on the upper portion of the stem by what is known as monopodial division, and before the opening of the florets identification becomes easy by the branching of the inflorescence, the disposition of the spikelets, and the character of the glumes. In Oats the flowers are arranged in

panicles, in the other three British cereals they are in spikes but again our shortest way is to put matters into tabular form :

Panicle. *Oats.*
Spike.
Spikelets solitary on each notch.
Glumes awl-shaped, with one nerve. *Rye.*
Glumes ovate, with three or more nerves. *Wheat.*
Spikelets two or three on each notch. *Barley.*

At a further stage in the flowering we are afforded another means of recognition, which we can again arrange in a table more likely to be remembered than the foregoing, as we are approaching what many may look upon as common knowledge—which it certainly is not to the ordinary townsman.

Spikelets on long stalks.
Florets two to six. *Oats.*
Spikelets sessile or apparently so.
Spikelets solitary.
Spikelets alike in size.
Terminal spikelet absent.
Florets two or three. *Rye.*
Lowest spikelet smaller than the rest.
With terminal spikelet, occasionally aborted.
Florets two to five. *Wheat.*
Spikelets in twos or threes.
Floret one. *Barley.*

Sometimes, in grey, cool weather, the florets do not open at all, and in that case the flower is necessarily self-pollinated. When this happens with Rye the result is sterility, but with our other three cereals this does not matter ; in fact, they are largely self-fertilised, owing to some of the pollen drifting on to the stigma when the anthers open and scatter it about in the air.

Generally speaking the florets open before breakfast on warm sunny mornings when the air is dry. In Wheat they only remain open for an hour or less, and for morning after morning for more than a week the pollination of each spike will go on.

The first florets to open are more than half-way up the spike, the next those immediately above and below the first morning's ring, and so on until the whole spikeful have contributed their share, and, as we have just said, in many cases fertilised themselves. Barley keeps its florets open longer than Wheat, and opens more at a time, so that the spike does not take so long to complete its pollination, but in more cases than not the florets do not open at all, and every one is fertilised from its own anthers.

When the grain ripens—and in many cases before by those experienced in such matters—we are in a position to say to what sub-species or variety the plant may be assigned. These are many, except with Rye, which we only know as Winter Rye, Summer Rye, and Midsummer Rye, according to the time of sowing, and is so unimportant in this country that it need not trouble us. We should note, however, that it has not been so long under cultivation as the other three, and though it is an annual, it is a perennial by recent descent, which the others do not seem to be. Wheat, when sown in the autumn, does not ripen and die until the following year, and when kept cut or well cropped by grazing, with plenty of room to branch, remains alive for two years or more. But we can hardly call it a perennial, as the ancestral species of Rye, *Secale montanum* of South Eastern Europe and Western Asia, undoubtedly is, though in its cultivated forms—*S. cereale*, and the less common *S. fragile* of Hungary—it has almost lost this characteristic, which is occasionally apparent when the stubble sprouts again after being left long in the ground.

Oats cannot be so briefly dismissed. Apparently the cultivated forms, one of them found in the Swiss lake dwellings and therefore of the Stone Age, arose from the Wild Oat, *Avena fatua*, but the pedigree is not convincing. Nowadays we have two main races, the Panicled Oat, *A. sativa*, and the Banner or Tartarian Oat, *A. orientalis*, with the panicle contracted and one-sided. Besides these we have the Chinese Oat, *A. chinensis*, belonging to the Panicled group; and *A. nuda*, the Naked Oat; *A. brevis*, the Short Oat; and *A. strigosa*, the Hairy or Bristle Oat, belonging to the Tartarian group.

Neither the Naked Oat nor the Chinese Oat seem to have

been grown in these islands, but the Short Oat has been grown here for fodder, and is still cultivated as a corn crop in the Pyrenees where other varieties fail to ripen, and the Hairy Oat is still in cultivation in Spain, in some parts of Northern Germany, and in the Shetlands and Orkneys, and used to be a common crop in Northern Scotland, where it has given place to more profitable kinds.

The Tartarian Oat is represented amongst us by the Black Oat and the White Oat and the seedsmen's strains of these varieties with which we need not concern ourselves. The Panicled Oat is represented by the several forms of the Potato, Sandy, Hopetoun, and Winter Dun types; but here again a tabular scheme will greatly help us:

Panicle spreading.
  Florets four to eight. *A. chinensis* (Chinese Oat).
  Florets two or three. *A. sativa* (Common Oat).
    Grain white and short. Potato type.
    Grain reddish white. Sandy type.
    Grain long, pale brown. Hopetoun type.
    Grain dark at base, brown in middle, paler at apex. Winter Dun type.
Panicle contracted and one-sided.
  Florets four to six. *A. nuda* (Naked Oat).
  Florets one or two.
    Lower floret stalked, grain short. *A. brevis.* (Short Oat.)
  Florets two or three.
    Outer palea bifid, with teeth prolonged into bristles. *A. strigosa* (Bristle or Hairy Oat).
    Outer palea not bristled. *A. orientalis* (Tartarian or Banner Oat).
      Grain white, straw tall and rigid. White Oat.
      Grain black, straw medium. Black Oat.

Barley and Wheat were cultivated in Switzerland before the Bronze Age, a quantity of both, carbonised at the burning of the lake city, having been found at Robenhausen, and bushels of both at Wangen. In these ancient stores two species of Barley

were recognisable, *Hordeum hexastichon*, found also in the oldest Egyptian monuments, not known wild and now cultivated only in Southern Europe, and *H. distichon*, which is derivable from *H. spontaneum*, now found native within the area enclosed by the Red Sea, the Caucasus, and the Caspian, the only differences being the non-articulate axis and the shorter awns. Four-rowed Barley, otherwise Bigg or Bere, *H. vulgare* (or, perhaps more frequently *H. sativum vulgare*), seems to be a further development of *H. distichon*, and comparatively recent, though prehistoric. One of its varieties, ripening within three months of its sowing, *H. pallidum*, is confined to the north of Europe and Asia; another, *H. cærulescens*, to Southern Europe and Northern Africa; and another group of its varieties is formed of the naked barleys of the Himalaya.

The following table gives the main distinctions:

All spikelets fertile. Lateral grains twisted.
Lateral spikelets in four straight rows. *H. hexastichon* (Six-rowed Barley).
Lateral spikelets in two irregular overlapping rows. *H. vulgare* (Four-rowed Barley).
Grain adherent. Common Barley.
Spikes pale yellow. *H. pallidum*
Spikes grey. *H. cærulescens*.
Grain free.
Awn simple. *H. cæleste* (Siberian or Naked Barley).
Awn three-pronged. *H. trifurcatum* (Nepal or Himalayan Barley).

Lateral spikelets barren. None of the grains twisted *H. distichon* (Two-rowed Barley).
Awns long and divergent. *H. zeocriton* (Fan, Battledore, or Peacock Barley).
Awns not divergent.
Grain bare. *H. nudum*.
Glumes of middle spikelet very narrow. *H. deficiens*.
Glumes of middle spikelet very broad. *H. macrolepis*.

Glumes medium.

Spikelets erect. Grain notched across base. Rachis stout, hairs long and numerous. *H. erectum.* (Goldthorpe type).

Spikelets nodding. Grain not notched across, but sloped at base. *H. nutans.*

Rachilla short and stout with short woolly hairs. Chevalier type.

Rachilla long and slender, with long upright hairs. Nottingham type.

Cultivated Wheat is quite as old as the Stone Age, and its origin is very doubtful, but Hackel divides the genus *Triticum* into two sections, *Ægilops* and *Sitopyros*, and through two of the twelve species of the former, *Æ. ovata* and *Æ. triuncialis*, obtains the transitions into the latter, which is made up entirely of our cultivated Wheats. Of these there are three main types, which are generally given specific rank—*Triticum monococcum*, *T. polonicum*, and *T. sativum*.

One-grained Wheat, *T. monococcum*, better known as Small Spelt, grows apparently wild on the hills of Thessaly, and ranges from Achaia to Mesopotamia. Thriving in stony places and giving good meal, though mostly used as mush and fodder, it is cultivated in the mountainous districts of Spain, France, and Eastern Europe. It was grown in the Stone Age at Aggtelek in Hungary, and also by the Swiss lake dwellers. A specimen was discovered in a brick of the pyramid of Dashur, showing that it was known to the Egyptians—to say nothing of the wall paintings—and it was also found by Schliemann among the ruins of Hissarlik, which he considered to be Troy. It is infertile when crossed with *T. sativum*, so that there are some real grounds for giving it a species to itself.

Polish Wheat, *T. polonicum*, when crossed with *T. sativum*, is satisfactorily fertile, and seems to be merely a cultivated variety. It is grown in Spain, where, notwithstanding its name, it apparently originated, in Italy, in Eastern Europe, and in Abyssinia. From its slender grain it has been called Giant Rye, and it is readily recognisable by its almost solid straw and

the great size of its glumes, which are frequently an inch in length, enclosing all the four florets of the spikelet, two of which are generally sterile.

Both these Wheats are of little importance compared with *T. sativum*, in which the glumes are shorter than the paleæ. Its culture is of great antiquity. Two of its varieties, Dwarf Wheat, *T. compactum*, and Starch Wheat, *T. dicoccum*, were stored in the Swiss lake dwellings. Grains of the main species have been found in the Egyptian pyramids, and *T. spelta* was the chief cereal of Egypt and Greece.

To be clear as to the distinctions between the species or varieties (they are all really varieties), let us put them into tabular form :

Terminal spikelet aborted. *T. monococcum* (One-grained Wheat).
Terminal spikelet developed.
Glumes not shorter than outer palea. *T. polonicum* (Polish Wheat).
Glumes shorter than outer palea. *T. sativum.*
Rachis brittle.
Spikes loose; glumes broadly truncate; keel obtuse. *T. spelta* (Spelt Wheat).
Spikes dense; glumes tapering; keel acute. *T. dicoccum* (Two-grained Spelt).
Rachis tough. *T. tenax.*
Glumes keeled throughout.
Grain pointed and compressed. *T. durum* (Hard Wheat).
Grain obtuse and not compressed.
Spike simple. *T. turgidum* (Rivet Wheat).
Spike compound. *T. compositum.* (Egyptian Wheat).
Glumes keeled at apex, rounded at base.
Plant dwarfed. Spikes quadrangular. *T. compactum* (Dwarf Wheat).
Plant not dwarfed. Spikes slightly compressed. *T. vulgare* (Common Wheat).

It will be seen we divide the varieties of *T. sativum* into those in which the rachis breaks off at the notches when thrashed and those in which it does not. The former includes only *T. spelta*, grown as a crop in Northern Spain and hardly anywhere else, and *T. dicoccum*, cultivated in Southern Europe from Spain to Servia. Both these, like *T. monococcum*, differ from the others, in the grain, though free, not falling out of the ear during the thrashing.

Hard Wheat is the flinty variety yielding the very glutinous flour which is made up into macaroni, vermicelli, etc., as being better adapted for such strong pastes than any other, and probably was the cause of their tubular shape. It is almost confined to the Mediterranean region, and is the principal grain of Spain and Northern Africa. It has a solid straw and long, bristly awns, these awns in some of its varieties being jet-black.

Rivet Wheat is another Mediterranean species, but unlike the foregoing the flour is much more starchy than glutinous. It grows tall, with thick quadrangular spikes, and broad velvety leaves, and in this country is grown only on a few clay lands in the south, though for some reason Hackel and other Germans call it English Wheat. Egyptian or Miracle Wheat, *T. compositum*, often described as a variety, has the spikes branched.

Dwarf Wheat, *T. compactum*, is the Hedgehog Wheat of the lake dwellers, a very old-established variety still cultivated in certain parts of Germany, in Turkestan, and elsewhere. Short and sturdy, it survives a good deal of rough treatment by the weather and otherwise. It was at one time grown a little in England, but was abandoned for something more profitable. In fact, of all these Wheats, with a few exceptions not worth mentioning, the only one seen in our fields is *T. vulgare*, beardless and bearded, in its hundreds of agricultural strains.

The genera of Oats and Barley, *Avena* and *Hordeum*, are represented in Britain by other species. Those of Rye and Wheat are not otherwise represented; in position they follow *Agropyrum*, the systematic sequence being *Agropyrum*, *Haynaldia*, *Secale*, *Triticum*, *Heteranthelium*, *Hordeum*.

CHAPTER V

THE ORDER AND ITS TRIBES.

THE grasses have a botanical order to themselves, Gramineæ, which is one of the two orders—Cyperaceæ being the other—forming the Glumifloræ, the most important and most widely distributed group—cohort or series, or whatever it may be called—into which the monocotyledonous plants have been divided.

The Glumifloræ are defined by Rendle as follows :

> "Flowers, small, naked or with a perianth represented by scales or hair-like structures, enclosed in scale-like bracts, and forming large, compound, indefinite inflorescences, Stamens usually in one whorl of three ; pistil of a single ovary, bearing one to three styles and enclosing a single ovule. Cross-pollinated by aid of wind, or self-pollinated. Fruit usually a caryopsis or nut ; seed containing a well-developed embryo and a large quantity of endosperm.
>
> "Annual or perennial herbs, or, in some tropical genera and species, shrubby or arborescent. Stem slender, with elongated internodes and alternate linear parallel-veined leaves, divided into sheath and blade, often with a membranous outgrowth, or ligule, at the line of union."

Keeping clear of theories which do not concern us, we can define the Gramineæ as plants in which the flowers are as a rule hermaphrodite, though rarely unisexual, placed generally above a chaff-like bract (the outer palea) and an opposite bract (the inner palea), and having at their base a pair of small scales (lodicules), one or both of which are, exceptionally, absent : stamens usually in a whorl of three (rarely two), sometimes in two alternating whorls, and in rare cases decreased to one or

increased to many; carpel single; ovary one-celled, usually with two, rarely with one or three, lateral stigmas; ovule solitary, with micropyle pointing downwards: fruit usually a caryopsis; embryo outside the endosperm in front at its base, small and straight with a shield-like development of the cotyledon towards the endosperm; radicle and plumule well-developed. Herbs, rarely shrubs or trees, mostly perennial, with jointed stems; leaves distichous, consisting of a sheath and blade with, generally, a ligule at the junction.

Hackel, whose classification is the best we have, divides the grasses into thirteen tribes, to which the following will be found a useful key. It is not quite the same as his, but good enough for practical purposes, and saves us from the repetition of details we shall have to deal with a page or so further on.

Stem woody.
Leaf often joined to sheath by a petiole. *BAMBUSÆ.*
Stem not woody.
Leaf not joined to sheath by a petiole.
Spikelets with one or two florets (lower floret when present imperfect) falling entire at maturity. Rachilla not produced beyond the florets. Internodes between glumes or florets, when present, not distinct.
Florets not laterally compressed.
Paleæ hyaline (that is glassy); lower glume the larger.
Spikelets male or female. *MAYDEÆ.*
Spikelets perfect or male and perfect. *ANDROPOGONEÆ.*
Paleæ not hyaline.
Paleæ membranous.
Lower glume the larger. *ZOYSIEÆ.*
Lower glume the smaller. *TRISTEGINEÆ.*
Paleæ not membranous. *PANICEÆ.*
Florets laterally compressed. *ORYZEÆ.*
Spikelets with one or many florets. Those with one floret frequently with rachilla produced beyond it; rachilla generally jointed above glumes so that these remain

after the fall of the paleæ. Internodes between glumes or florets distinct.

Glumes four. Florets one or three. *PHALARIDEÆ.*

Glumes two (rarely more).

Spikelets with one floret. *AGROSTIDEÆ.*

Spikelets with two or more florets.

Spikelets in panicles or racemes.

Glumes generally longer than outer palea, usually with a bent dorsal awn. *AVENEÆ.*

Glumes generally shorter than outer palea, usually unawned or with a straight terminal awn. *FESTUCEÆ.*

Spikelets in double rows, the spike one-sided. *CHLORIDEÆ.*

Spikelets in opposite rows, spike two-sided. *HORDEÆ.*

Looking down this arrangement we notice at once that five of the tribes—Bambusæ, Maydeæ, Andropogoneæ, Zoysieæ, and Tristegineæ—are not British and need not concern us ; and that by viewing the table from a purely British point of view we can simplify matters much further. And so we can ; the following being the key with which we have worked through our native genera :

Glumes 4. *PHALARIDEÆ.*

Glumes 3. *PANICEÆ*

Glumes 0. *ORYZEÆ.*

Glumes 2.

Florets one. *AGROSTIDEÆ.*

Florets more than one

Spikes.

Spikelets in two rows on one side. *CHLORIDEÆ.*

Spikelets in two opposite rows in notches. *HORDEÆ.*

Spikelets in two opposite rows turning to one side. *FESTUCEÆ* (as regards *Poa loliacea*).

Panicles.

Spikelets with a terminally awned male floret above an awnless perfect floret, or with all the outer paleæ dorsally awned, and the rachilla hairless or having short hairs. *AVENEÆ.*

Spikelets otherwise. *FESTUCEÆ.*

These are our eight British tribes, and we can get our best description of them by re-assembling Hackel's key with additions.

PANICEÆ. Spikelets in spikes, racemes or panicles, axis usually continuous. One-floret; occasionally two florets, lower floret, when present, male or very rarely perfect, in the axil of the third glume. Spikelets falling from the pedicel entire or together with certain joints of the rachis at maturity. Rachilla not produced beyond the florets. Internodes between the different glumes or flowers not measurable. Spikelets not flattened laterally, but usually somewhat dorsally compressed or else perfectly round. Paleæ of the perfect floret firmer in texture than the glumes, and unawned. Glumes, one, two, or three, rarely awned. Seed unfurrowed, embryo nearly half as large as fruit. Starch grains simple, polyhedral to roundish. Hilum punctiform.

Represented in Britain by only one genus, *Panicum* 3-8.

ORYZEÆ. Spikelets with one floret, which falls from the pedicel entire or together with certain joints of the rachis at maturity. Rachilla not produced beyond the florets. Internodes between the different glumes or florets not measurable. Spikelets laterally compressed. Florets enclosed by paleæ, inner palea usually with a single nerve. Glumes two or more, very rarely numerous. Stamens, one, two, three, or frequently six, Stigmas elongated. Fruit with a small embryo. Starch grains compound. Hilum linear.

Represented in Britain by only one genus, *Leersia* 1

PHALARIDEÆ. Spikelets with one floret or with one perfect and one or two male florets. Rachilla frequently produced beyond the florets, and generally articulated above the glumes,

so that they remain after the fall of the paleæ. Glumes four, unequal, third and fourth occasionally very small or one of them rudimentary. Paleæ laterally compressed, nerves one or none, awnless. Spikelets upon pedicels in panicles, spike-like panicles or racemes without notches on the main axis. Stigmas usually projecting from the point of the spikelet. Seed unfurrowed, embryo small. Starch grains compound.

Represented in Britain by four genera, *Phalaris* 11, *Digraphis* 12, *Anthoxanthum* 10, *Hierochloe* 9.

Agrostideæ. Spikelets with one floret; rachilla sometimes produced beyond the palea and generally articulated above the glumes, so that they remain after the fall of the paleæ. Glumes two (very exceptionally none), often unequal, usually at least as long as the outer palea. Palea with two nerves. Spikelets upon pedicels in panicles, spike-like panicles or racemes, without notches on the main axis. Seed unfurrowed, embryo small; starch grains compound.

Represented in Britain by ten genera, *Milium* 2, *Phleum* 13-17, *Alopecurus* 18-21, *Mibora* 22, *Polypogon* 24, 25, *Agrostis* 26-29, *Gastridium* 30, *Calamagrostis* 32-35, *Psamma* 31, *Lagurus* 23.

Aveneæ. Spikelets with two or more florets (exceptionally with one); rachilla frequently produced beyond the florets and generally articulated above the glumes, which often remain after the fall of the paleæ. Distinct internodes between the florets. Spikelets in panicles, rarely in spikes. Florets all perfect or one of them male. Outer palea generally shorter than glumes and awned on the back; awn bent, rarely nearly straight; inner palea with two keels. Style short or absent; stigmas feathery, protruding above the base or middle of the spikelet. Seed usually furrowed; embryo small; starch grains compound.

Represented in Britain by four genera, *Holcus* 45, 46, *Aira* 36-40, *Avena* 41-43, *Arrhenatherum* 10.

Festuceæ. Spikelets with two or more florets (rarely with one), usually perfect; rachilla frequently produced beyond the

florets and generally articulated above the glumes, which often remain after the fall of the paleæ. Distinct internodes between the florets. Spikelets in panicles or apparent spikes. Glumes generally shorter than inner palea ; inner palea awnless or with from one to many awns, which are usually terminal, rarely dorsal, and straight, though occasionally geniculate. Inner palea with two keels. Embryo, as a rule, small ; starch grains mostly compound.

Represented in Britain by fourteen genera, *Sesleria* 100, *Arundo* 101, *Triodia* 98, *Molinia* 95, *Koeleria* 99, *Catabrosa* 94, *Melica* 96, 97, *Briza* 77, 78, *Dactylis* 74, *Cynosurus* 75, 76, *Poa* 79-93, *Festuca* 69-73, *Bromus* 62-68, *Brachypodium* 60, 61.

CHLORIDEÆ. Spikelets with one or more florets, in two series upon one side of the continuous rachis ; outer palea deciduous with the fruit, the glumes rarely falling with them. Inner palea with two nerves. Styles distinct ; stigmas projecting from the sides, occasionally from just below the apex. Seed free, unfurrowed ; starch grains generally compound.

Represented in Britain by two genera, *Cynodon* 47, *Spartina* 48.

HORDEÆ. Spikelets sessile on notches of the rachis, in two or more rows, forming an equilateral or (rarely) unilateral spike. Florets one or more, uppermost floret imperfect when there are more than one.

Represented in Britain by six genera, *Nardus* 50, *Lolium* 58, 59, *Lepturus* 49, *Agropyrum* 56, 57, *Hordeum* 52-55, *Elymus* 51.

CHAPTER VI.

THE TRIBES AND THEIR GENERA.

AGROSTIDEÆ.

Panicles.

Florets hairy at base; leaves rough.

Hairs few and short. *Agrostis*, 26-29.

Hairs numerous, long and silky. *Calamagrostis*, 32-35.

Florets not hairy at base; leaves smooth and broad. *Milium*, 2.

Spikes.

Spikelets alternate in two opposite rows. *Mibora*, 22.

Spike ovoid, almost globular. *Lagurus*, 23.

Spike tapering from base.

Spikelets compressed. *Polypogon*, 24, 25.

Spikelets not compressed. *Gastridium*, 30.

Spike fusiform or cylindrical.

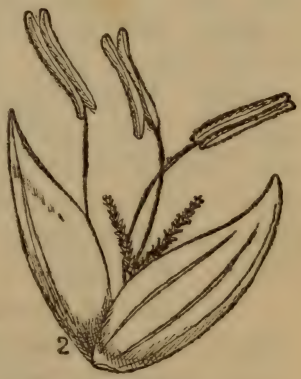
Ligule lengthy and bifid. *Psamma*, 31.

Ligule not lengthy and bifid.

Spike bristly. *Phleum*, 13-17.

Spike silky. *Alopecurus*, 18-21.

MILIUM. Spikelets cylindrical, stalked, awnless. Glumes two, nearly equal, membranous, enclosing floret, tumid, ovate, pointed. Outer palea smaller, ovate, convex, permanent, finally indurated, enclosing the seed. Lodicules two, ovate, obtuse; stamens three, filiform, short, ovary roundish; styles two; stigmas tufted.



Milium effusum.
Floret. For Spikelet see p. 114.

Panicle diffuse; leaves reversed at base so that the upper side is really the under side.

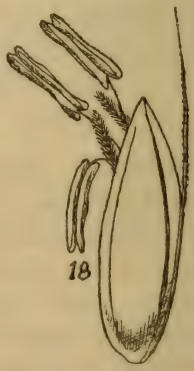
Species. *M. effusum*, 2.

PHLEUM. Panicle spike-like. Glumes oblong, linear-lanceolate, compressed, nearly equal, pointed or awned. Paleæ shorter, concealed within the glumes, awnless and very thin; sometimes a minute awn on the back of outer palea, or a bristle at base of inner palea. Inner palea with two ribs. Lodicules ovate, concave, acute. Stamens three; anthers oblong; filaments capillary, longer than glumes. Styles two; stigmas feathery with short branches, protruding from apex of spikelet. Grain roundish, enveloped by paleæ but not united to them.

Phleum pratense.
Floret.
For Spikelet see p. 12

Species. *P. pratense*, 13
P. alpinum, 14.
P. boehmeri, 15.
P. asperum, 16.
P. arenarium, 17.

ALOPECURUS. Glumes equal, ovate-lanceolate, concave, compressed, connate at base, awnless. Outer palea thin, ovate-lanceolate, concave, with a slight, bent, dorsal awn and fringed on keel. Inner palea often absent. No lodicules. Stamens three; filaments flattened at base; anthers forked at each end. Ovary roundish; styles capillary, united at base; stigmas with short branches protruding from apex of spikelet; grain loose or not enclosed.



Alopecurus agrestis.
Floret.
For Spikelet see p. 73.

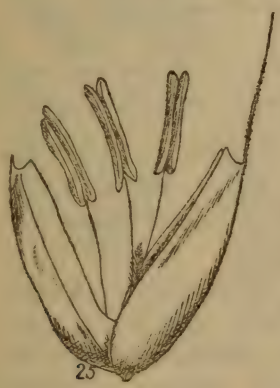
Species. *A. agrestis*, 18.
A. pratensis, 19.
A. geniculatus, 20.
A. alpinus, 21.

MIBORA. Spike simple and slender. Glumes equal or nearly so, erect, oblong, abrupt, keeled, awnless. Outer palea rather shorter than glumes, very thin, white, hairy. Inner palea absent or little more than a tuft of hair. Stamens three, filaments capillary, twice as long as outer palea. Ovary ovate; stigmas long, slender, downy, with short branches, protruding from apex of spikelet. Grain elliptical, enclosed in glumes but not united to them. Leaves short and setaceous.

Mibora verna.
Floret. For Spikelet see p. 113.

Species. *M. verna*, 22.

POLYPOGON. Panicle spike-like. Glumes nearly equal, narrow, straight, concave, bifid, with long slender awns. Outer palea about half as long as glumes, thin, broadish, notched at apex, awned. Inner palea notched at apex, thin, transparent, narrow, awnless. Lodicules oblong. Stamens three; filaments capillary, as long as outer palea; anthers oblong. Ovary ovate; styles two, wide apart; stigmas pectinately branched, usually protruding from sides of spikelets. Grain ovate, enveloped by paleæ.



Polypogon littoralis.
Floret. For Spikelet see p. 135.

Species. *P. monspeliensis*, 24.
P. littoralis, 25.

AGROSTIS. Panicle variable but more or less diffuse. Spikelets small. Outer glumes persistent, longer than paleæ, equal, narrow, pointed, awnless. Outer palea thin, membranous or

Agrostis alba.
Floret. For Spikelet see p. 67.

hyaline, generally with a dorsal awn. Inner palea short and small, or absent. Stamens three. Stigmas pectinately branched, usually protruding from sides of spikelets. Grain enveloped by paleæ.

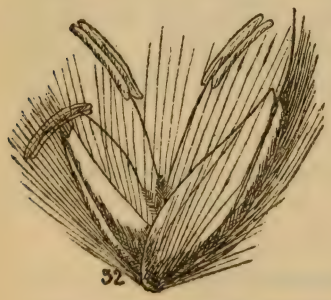
Species. *A. alba*, 26.
A. canina, 27
A. setacea, 28.
A. spica-venti, 29.

GASTRIDIUM. Panicle dense, spike-like, spikelets narrow and shining. Rachilla extending beyond paleæ. Glumes persistent, unequal, swollen at base, acute, smooth, shining. Outer palea a third as long as glumes, thin. Stamens three. Stigmas pectinately branched, usually protruding from sides of spikelets. Grain enveloped by paleæ.

Species. *G. lendigerum*, 30.

Gastridium lendigerum.
Floret.
For Spikelet see p. 101.

CALAMAGROSTIS.—Panicle variable. Rachilla extending beyond paleæ. Glumes persistent, nearly equal, keeled. Outer palea thin, membranous, narrow, short, awned. Stamens three. Stigmas pectinately branched and usually protruding from sides of spikelets. Grain enveloped in paleæ. Broader leaves twisted to the left.

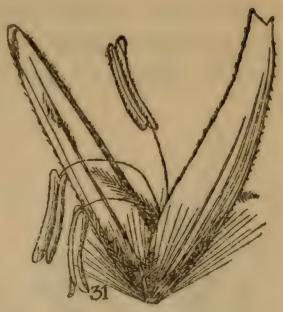


Calamagrostis epigeios.
Floret. For Spikelet see p. 89.

Species. *C. epigeios*, 32.
C. lanceolata, 33
C. stricta, 34.
C. strigosa, 35.

PSAMMA. Panicle spike-like, narrow, cylindrical. Spikelets rather large. Rachilla extending beyond paleæ. Glumes persistent, stiff. Paleæ chartaceous. Outer palea thin, somewhat indurated, awnless. Inner palea with two ribs. Stamens three. Stigmas pectinately branched, usually protruding from sides of spikelet. Grain enveloped in paleæ.

Species. *P. arenaria*, 31.



Psamma arenaria.
Floret. For Spikelet see p. 135.

LAGURUS. Panicle spike-like or capitate. Spikelets very hairy. Glumes persistent, long, narrow, spreading, bearing plumose hairs. Outer palea firm, shorter than glumes, with two awns forking from its apex and a long dorsal awn. Inner palea shorter than outer, with two ribs, a pair of awns at its apex, smaller than those of the outer palea. Lodicules lanceolate, blunt, tumid at base. Stamens three; filaments capillary, anthers oblong, pendulous, notched at each end. Ovary oblong; styles short. Stigmas long, pectinately branched and protruding from sides of spikelet. Grain enveloped in paleæ.

Lagurus ovatus.
Floret.
For Spikelet see p. 107.

Species. *L. ovatus*, 23.

AVENEÆ.

Florets three or more. *Avena*, 41-43.

Florets two.

Both florets perfect. *Aira*, 36-40.

Upper floret perfect. *Arrhenatherum*, 10.

Lower floret perfect. *Holcus*, 45, 46.

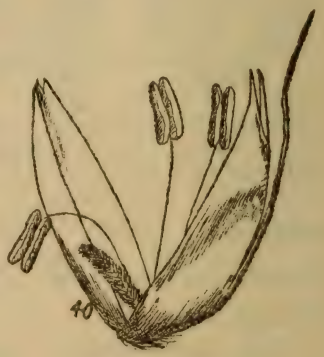
Holcus. Inflorescence a panicle. Spikelets falling entire. Florets two, upper floret male, awned; lower floret perfect, awnless. Glumes erect, beardless, ovate, compressed, keeled, enclosing florets, one of which is stalked. Outer palea pointed, that of male floret with a dorsal awn. Inner palea smaller, awnless, apex entire. Lodicules single, bifid, membranous. Stamens three. Ovary ovate. Style short or absent. Stigmas oblong and feathery, protruding above the base or middle of the floret. Grain ovate, attached to the indurated paleæ. Broader leaves twisted to the left.

Holcus lanatus.
Floret. For Spikelet see p. 103.

Species. *H. lanatus*, 45.
H. mollis, 46.

Aira. Panicles loose. Spikelets small. Florets two, nearly sessile. Glumes equal, ovate-lanceolate, acute, thin, membranous, persistent. Outer palea like glumes in height and texture, bifid at apex, rounded on back, awn dorsal and short. Inner palea two-nerved. Stamens three; filaments long and capillary; anthers oblong, forked at each end. Ovary glabrous. Styles bristle shaped, spreading. Stigmas feathery, protruding above the base or middle of the spikelet.

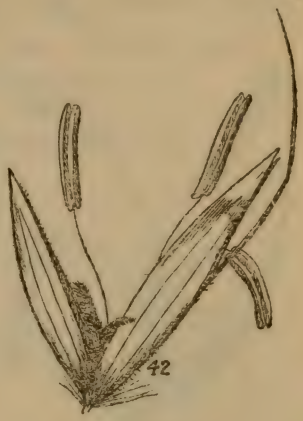
Species. *A. cæspitosa*, 36.
A. flexuosa, 37.
A. canescens, 38.
A. præcox, 39.
A. caryophyllea, 40.



Aira caryophyllea.
Floret. For Spikelet see p. 72.

AVENA. Panicles loose. Spikelets with two or more florets. Rachilla extending beyond upper floret. Glumes unequal, membranous, lanceolate, acute, ventricose, loose, persistent, awnless. Outer palea slightly smaller, with lateral veins, ending in two points, awned ; awn dorsal, kneed, twisted. Lodicules two. Stamens three ; filaments thin, capillary. Ovary hairy at apex. Stigmas protruding above the base or middle of the spikelet. Grain fusiform, deeply grooved, hairy at apex, enclosed by the paleæ. Starch grains compound.

Species. *A. fatua*, 41.
A. pratensis, 42.
A. flavescens, 43.



Avena pratensis.
Floret. For Spikelet see p. 80.

ARRHENATHERUM. Spikelets upright. Florets two, upper perfect, lower male and awned. Rachilla prolonged beyond upper floret. Glumes unequal, membranous, persistent. Outer palea of upper floret awned from the point or awnless. Outer palea of lower floret awned from below the middle, awn long, bent, and twisted. Inner paleæ herbaceous, ending in two points. Lodicules two. Stamens three. Ovary hairy at apex. Stigmas protruding above the base or middle of the spikelet. Grain oblong, not grooved, hairy at apex, enclosed by the paleæ

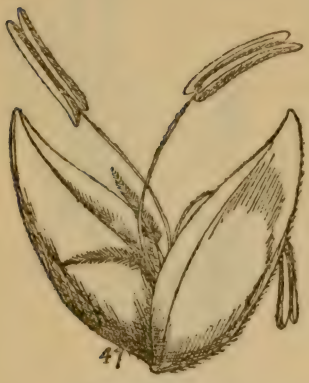
Arrhenatherum avenaceum.
Floret. For Spikelet see p. 77.

Species. *A. avenaceum*, 44.

CHLORIDEÆ.

Spikes digitate ; spikelets small. *Cynodon*, 47

Spikes upright ; spikelets large. *Spartina*, 48.



Cynodon dactylon.
Floret. For Spikelet see p. 91.

CYNODON. Spikes digitate, radially divergent. Spikelets small, in two series, on one side of the spike, awnless. Florets one. Glumes nearly equal, narrow, patent, persistent. Outer palea longer and broader than glumes, ciliate on keel, compressed, embracing inner palea. Stamens three. Styles long, distinct. Stigmas feathery, protruding from sides of spikelets.

Species. *C. dactylon*, 47.

SPARTINA. Spikes two or more, usually upright. Spikelets generally awnless, large, compressed, falling entire. Florets one, sessile. Glumes boat-shaped, compressed, converging, very unequal ; outer glume broad and striated, inner glume lanceolate. Outer palea nearly as long as longer glume, linear, compressed, narrowing to a point at apex. Inner palea about as long. Lodicules none. Stamens three ; filaments slender, anthers long. Ovary narrow and pointed. Styles thin, longer than filaments, united half way up. Stigma short, feathery. Grain compressed.

Species. *S. stricta*, 48.

Spartina stricta.
Floret. For Spikelet see p. 137.

FESTUCEÆ.

Spikes.
Simple.
Spikelets on one side. *Cynosurus*, 75, 76.
Spikelets imbricated; bract at base. *Sesleria*, 100.
Spike interrupted near base. *Koeleria*, 99.
Compound.
Spikelets on both sides. *Brachypodium*, 60, 61.

Panicles.
Spikelets orbicular. *Briza*, 77, 78.
Sheath quadrangular. *Melica*, 96, 97.
Stem solid. *Molinia*, 95.
Leaves glaucous above, dark green below. *Triodia*, 98.
Florets enveloped in silky hairs of axis. *Arundo*, 101.
Panicle tufted. *Dactylis*, 74.
Panicle diffuse.
Awned.
Awn of outer palea sub-terminal, style sub-terminal. *Bromus*, 62-68.
Awn of outer palea terminal; style terminal. *Festuca*, 69-73.
Awnless.
Glumes truncate, panicle whorled. *Catabrosa*, 94.
Glumes short or pointed. *Poa*, 79-93.
Glumes long and lanceolate. *Festuca*, 69, 70 (as regards *F. ovina* and *F. elatior*).

SESLERIA. Panicle dense and spike-like or capitate. Spikelets imbricate, sessile, persistent. Florets few. Glumes nearly equal, ovate-lanceolate, concave, acute, keeled, membranous. Outer palea erect, acute, entire or toothed, awnless or

Sesleria cærulea.
Floret. For Spikelet see p. 136

with one awn. Inner palea folded, two-ribbed, cleft. Stamens three; filaments capillary, long; anthers pendulous, oblong. Styles two, varying in length, sometimes united. Stigmas long, cylindrical, feathery, protruding at or near apex of floret, with short hairs on all sides. Grain ovate, smooth.

Species. *S. cærulea*, 100.

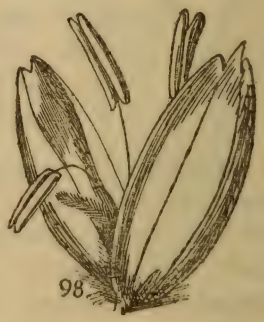
Arundo phragmites.
Floret For Spikelet see p. 78.

ARUNDO. Panicle large and crowded, more or less drooping. Spikelets long and narrow with many florets. Lowermost floret male, the others perfect. Rachilla with long hairs. Glumes unequal, oblong, pointed. Outer palea membranous or hyaline, nerves three, long, pointed, awnless or with a small terminal awn. Inner palea as long as outer, of same length as glumes. Stigmas long and narrow, protruding from the middle section of the floret. Numerous long, silky, silvery hairs from base of floret. Leaves flat and broad.

Species. *A. phragmites*, 101.

TRIODIA. Panicle open. Spikelets alike. Florets three or more. Glumes nearly equal. Outer palea coriaceous or chartaceous, with three teeth and parallel veins which do not join to form an awn, middle tooth pointed. Stamens three. Styles terminal. Stigmas plumose, protruding from sides of outer palea. Grain free.

Species. *T. decumbens*, 98.



Triodia decumbens.
Floret. For Spikelet see p. 138.

Molinia cærulea.
Floret. For Spikelet see p. 115.

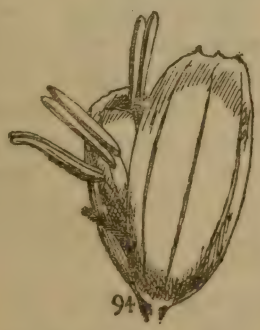
MOLINIA. Panicle branches in a spiral. Spikelets alike, small, conical. Florets two, three, or four. Rachilla articulated. Glumes unequal, without lateral ribs, pointed. Outer palea with three nerves, awnless. Inner palea small with a bristle at its base. Paleæ indurated on seed. Stamens three. Stigmas plumose, protruding from sides of outer palea.

Species. *M. cærulea*, 95.

KOELERIA. Panicle spike-like, branches distichous. Spikelets alike, compressed. Florets two to five, shining. Glumes unequal, inner glume with two or three ribs. Outer palea entire, keeled, pointed or with a straight sub-terminal bristle, three-nerved. Stamens three. Stigmas plumose, protruding from sides of outer palea.

Species. *K. cristata*, 99.

Koeleria cristata.
Floret. For Spikelet see p. 107.



Catabrosa aquatica.
Floret. For Spikelet see p. 91.

CATABROSA. Panicle diffuse, branches long and slender. Spikelets all similar, small. Florets two, rounded on back, distant. Glumes broad, short, blunt at the apex or indented, unequal, awnless. Outer glume with one vein ; inner with two short lateral veins. Outer palea membranous, with three veins ending in teeth. Stamens three. Stigmas plumose, protruding from sides of outer palea.

Species. *C. aquatica*, 94.

MELICA. Panicle narrow. Spikelets few and large, containing one or more florets and a club-shaped glume enclosing one or more rudimentary florets. Glumes ovate, concave, thin, nearly equal, with lateral ribs. Outer palea ovate, concave; inner palea ovate, flat. Lodicules single, fleshy, horizontal. Ovary turbinate. Stigmas long, feathery. Stamens three, filaments capillary, thickened at base; anthers oblong. Styles two, bristle-shaped, spreading. Paleæ hardening on grain, which is ovate and grooved.

Melica uniflora.
Floret.
For Spikelet see p. 112.

Species. *M. nutans*, 96.
M. uniflora, 97.

BRIZA. Panicle loose. Spikelets purplish or pale green, ovate or triangular, broad, short, distichous, pendulous. Florets three to eight, densely imbricate. Outer glumes nearly equal, longer or shorter than the lowermost floret, broad, blunt, membranous, margin scarious, concave, ribs five, or more. Outer palea blunt, cartilaginous, boat-shaped, cordate at base, rounded on back, without lateral projections, veins separate throughout. Inner palea much shorter than outer palea, very small, flat and roundish. Lodicules two, narrow, notched. Stamens three, filaments capillary, anthers oblong. Ovary roundish. Styles two. Stigmas feathery. Grain very flat, dorsally compressed and adherent to paleæ.

Briza minor.
Floret. For Spikelet see p. 83.

Species. *B. media*, 77
B. minor, 78

DACTYLIS. Panicle one-sided. Spikelets in clusters. Florets three to five, concave on inner side. Glumes unequal, pointed, keeled, convex, herbaceous. Outer palea compressed, keeled, keel fringed, apex continued as a short awn. Lodicules lanceolate, tumid at base. Stamens three; filaments longer than outer palea, slender. Styles spreading. Stigmas feathery. Grain oblong, naked, grooved, free.

Species. *D. glomerata*, 74.

Dactylis glomerata.
Floret. For Spikelet see p. 94.

CYNOSURUS. Panicle spike-like or capitate, one-sided. Spikelets of two forms in sessile clusters. Each spikelet with a comb-like bract at base. Barren spikelets with awned or pointed glumes; fertile spikelets with two or three florets. Glumes two, nearly equal, keeled. Outer palea long, concave, with terminal bristle. Inner palea flat, awnless. Lodicules ovate, acute, swollen at base. Stamens three; filaments capillary; anthers oblong, pointed. Styles reflexed, hairy. Stigmas plumose, protruding from sides. Grain oblong, closely covered with paleæ.

Cynosurus cristatus.
Floret. For Spikelet see p. 92.

Species. *C. cristatus*, 75.
C. echinatus, 76

POA. Panicle simple or compound; branches in whorls of one to five. Spikelets not imbricated or clustered. Rachilla often hairy. Florets many, awnless. Glumes rather unequal, ovate, pointed, mostly keeled, awnless, herbaceous or

Poa pratensis.
Floret. For Spikelet see p. 130.

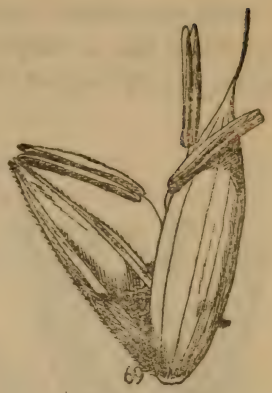
membranous. Outer palea ovate, concave, lateral nerves arched, converging above, more or less keeled, compressed, rather longer than glumes, membranous at margin. Lodicules acute or torn, swollen at base. Stamens three. Ovary roundish. Styles two, rising at or near the apex of the ovary, reflexed, hairy. Stigmas plumose. Grain oblong, pointed, compressed on each side. Hilum punctiform.

Species. *P. aquatica*, 79.
P. fluitans, 80.
P. maritima, 81.
P. distans, 82.
P. procumbens, 83.
P. rigida, 84.
P. loliacea, 85.
P. annua, 86.
P. compressa, 87
P. pratensis, 88.
P. trivialis, 89.
P. nemoralis, 90.
P. laxa, 91.
P. alpina, 92.
P. bulbosa, 93.

FESTUCA. Spikelets lanceolate, roughish. Florets two or more. Glumes erect, unequal, herbaceous, keeled. Outer palea rough, chartaceous to membranous, lanceolate, rounded on the back, five nerves, laterals arched and converging, pointed or awned, often keeled above. Inner palea minutely ciliate. Lodicules either two, ovate-lanceolate, acute, or one, concave, notched, horizontal. Stamens three; filaments capillary, shorter than outer palea; anthers, like stigmas, protruding when in flower

Ovary turbinate, glabrous, sometimes rather downy. Styles two, terminal, short, almost wanting, reflexed. Stigmas downy. Grain long, slender, sharply pointed at both ends, usually grooved on inner side, adherent to palea. Hilum linear. Broader leaves twisted to the left.

Species. *F. ovina*, 69.
F. elatior, 70.
F. sylvatica, 71.
F. myurus, 72.
F. uniglumis, 73.



Festuca ovina.
Floret. For Spikelet see p. 97.

Bromus. Panicle branches in whorls. Spikelets usually large, neither imbricated nor clustered. Florets many. Glumes unequal, herbaceous, ovate, pointed, awnless, outer with one vein, inner with three to five veins, inner the smaller. Outer palea like outer glume in shape and size, concave, obtuse, cleft at apex with a straight awn rising just below it. Inner palea lanceolate, small, awnless, nerved, nerves hairy. Lodicules ovate, acute, swollen at base. Stigmas three, sessile on anterior side. Ovary hairy, lobed at apex. Styles two, short, reflexed, hairy, placed on the side of the ovary below the apex. Stigmas simple. Grain oblong, convex on one side, grooved on the other, adherent to paleæ starch grains simple, roundish.

Bromus giganteus.
Floret. For Spikelet see p. 88.

Species. *B. erectus*, 62.
B. asper, 63.
B. sterilis, 64.
B. maximus, 65.
B. madritensis, 66.
B. arvensis, 67.
B. giganteus, 68.

BRACHYPODIUM. Inflorescence really a simple raceme, but appearing like a compound spike. Florets many, almost cylindrical, shortly stalked or sub-sessile, edgeways to rachis. Glumes opposite, unequal, awnless. Outer palea rounded on the back, usually awned from apex, margin entire, nerves seven to nine, laterals arched and converging. Inner palea pectinately fringed on ribs. Stamens three. Stigmas two, inserted at or near apex of ovary. Style very short. Grain adherent to paleæ; starch grains simple and roundish.

Brachypodium sylvaticum.
Floret. For Spikelet see p. 81.

Species. *B. sylvaticum*, 60.
B. pinnatum, 61.

HORDEÆ.

Style one. *Nardus*, 50.
Styles two.
Spikelets in threes. *Hordeum*, 52-55.
Spikelets in pairs. *Elymus*, 51.
Spikelets in ones.
Axis jointed at each notch. *Lepturus*, 49.
Axis not jointed at each notch.
Spikelets close. *Lolium*, 58, 59.
Spikelets distant. *Agropyrum*, 56, 57.

NARDUS. Spike slender, unilateral. Spikelets sessile in the notches of the continuous wiry stem; not opening in flower; both series close together. Florets one. Glumes only one, small, indistinct, grown to the stem. Outer palea narrow, pointed or awned, embracing inner palea, which is smaller. No lodicules. Stamens three; filaments slender, shorter than the glume; anthers oblong. Style single, slender, long, downy. Stigma

Nardus stricta.
Ovary and stigma.
For Spikelet see p. 116.

simple, protruding, with anthers, from apex of floret. Starch grains compound. Leaves erect, rigid, subulate.

Species. *N. stricta*, 50.

LOLIUM. Spike symmetrical. Spikelets solitary. Terminal spikelets with two empty glumes. Rachis notched, not jointed; spikelets placed singly on each notch, and pressed close into the angle. Florets many. Glumes with their backs turned to notches in the rachis. Outer palea lanceolate, narrow, pointed, as long as the glume. Lodicules ovate, obtuse, swollen at base. Stamens three, filaments short. Stigmas two. Grain enclosed in paleæ and falling only when they open, oblong, convex beneath, and broad, with a shallow groove above. Starch grains compound.

Lolium perenne.
Floret. For Spikelet see p. 110

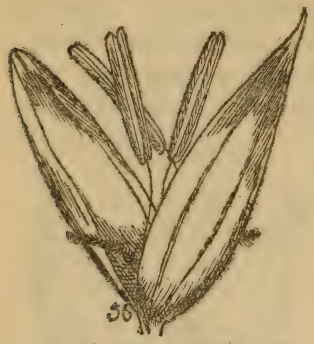
Species. *L. perenne*, 58.
L. temulentum, 59.

LEPTURUS. Spike symmetrical, slender, jointed, the joints breaking off with the adjoining spikelet at maturity. Spikelets alternate, solitary, sessile, with the sides turned towards the notches. Rachilla prolonged and naked. Florets, one or two. Glumes two, hard, thin, ribbed. Two opposite empty glumes in the terminal spikelet. Outer palea very thin, awnless. Stamens three. Stigmas two. Starch grains compound.

Lepturus incurvatus.
Floret. For Spikelet see p. 109.

Species. *L. incurvatus*, 49.

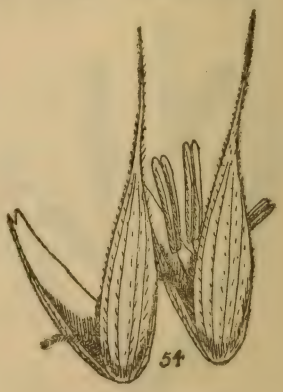
AGROPYRUM. Spike stout. Spikelets solitary, quite sessile, with their sides turned towards the notches, more or less compressed. Rachis articulate or continuous. Florets three or more. Glumes opposite, equal, bluntish, concave. Outer palea coriaceous, rounded on the back or slightly keeled, awnless or awned, with callus limited by a furrow at the base. Inner palea minutely ciliate on the ribs. Lodicules two, swollen at the base. Stamens three, filaments capillary; anthers oblong, cleft at each end, pendulous. Ovary turbinate. Styles two, slender, reflexed. Stigmas feathery. Grain ovate, oblong, blunt at both ends, hairy at apex, convex on outer side, grooved on inner, falling off at maturity with the paleæ and callus adherent to it. Starch grains simple. Broader leaves twisted to the right.



Agropyrum repens.
Floret. For Spikelet see p. 65.

Species. *A. repens*, 56. *A. caninum*, 57.

HORDEUM. Spike stoutish. Spikelets in threes, in each notch of the stem, stem jointed and breaking at the notches. Florets one or with a rudiment of a second. Glumes narrow, usually subulate, pointed and ending in a bristly awn. Outer palea with five nerves ending in a strong awn. Stamens three. Ovary turbinate. Styles two, villous, reflexed. Stigmas feathery. Grain oblong, swelling, angular and pointed at each end, apex hairy, marked with a longitudinal groove, adherent to outer palea. Starch grains simple.



Hordeum murinum.
Floret. For Spikelet see p. 105.

Species. *H. sylvaticum*, 52.
H. pratense, 53. *H. murinum*, 54. *H. maritimum*, 55.

ELYMUS. Spike stoutish. Spikelets sessile, containing more than one floret. Terminal spikelet with two glumes on the same side, one of them frequently aborted. Lateral spikelets in groups of from two to six, all fertile. Glumes narrow, awnless, and without bristles. Outer palea pointed, awnless or awned, oblong or lanceolate, with five nerves, not keeled. Inner palea fringed. Lodicules two, oblong, pointed, fringed. Stamens three; filaments slender, very short; anthers oblong, more deeply notched at base than at apex. Ovary turbinate. Styles two, short. Stigmas feathery. Grain adherent to paleæ.

Species. *E. arenarius*, 51.

Elymus arenarius.
Floret. For Spikelet see p. 96.

ORYZEÆ

LEERSIA. Panicle loose. Spikelets laterally compressed. Florets one. Glumes absent or represented by rudiments. Outer palea awnless, concave, keeled, generally fringed. Inner palea narrower than outer but of same length. Lodicules lanceolate, acute. Stamens one, two, three or six; filaments short; anthers oblong. Ovary ovate, compressed. Styles two, capillary, short. Stigmas feathery, protruding near base of floret. Grain obovate, compressed, enclosed in paleæ but not adherent. Starch grains compound.

Leersia oryzoides.
Floret. For Spikelet see p. 108.

Species. *L. oryzoides*, 1.

PANICEÆ.

PANICUM. Panicle compact or spike-like, or more or less spreading. Spikelets dorsally compressed, small, naked, or awned. Florets one, or only one perfect with an inferior rudiment or barren floret. Glumes generally three, the lowest minute, the second larger and empty, the third often containing a male floret. Paleæ awnless or with short awns. Outer palea concave, indurated, with no lateral appendages or pits at base, embracing with its margins the inner palea, which is likewise indurated and glossy and of similar shape, but flatter, with two slight ribs. Lodicules minute, inflated. Stamens three. Ovary roundish. Stigmas two. Grain enclosed by paleæ, flattened on one side.

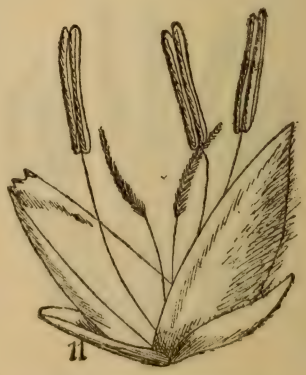
Panicum viride.
Floret. For Spikelet see p. 118.

Species. *P. sanguinale*, 3.
P. glabrum, 4.
P. verticillatum, 5.
P. glaucum, 6.
P. viride, 7.
P. crus-galli, 8.

PHALARIDEÆ.

Florets one.
Spike. *Phalaris*, 11.
Panicle. *Digraphis*, 12.
Florets three.
Spike; middle floret perfect. *Anthoxanthum*, 10.
Panicle; uppermost floret perfect. *Hierochloe*, 9.

PHALARIS. Spike ovoid or cylindrical. Spikelets imbricated. Florets one. Glumes four, unequal, the third and fourth reduced to scales, the first and second nearly equal,



Phalaris canariensis.
Floret. For Spikelet see p. 119.

concave, keel winged, the two pressed closely together. Outer palea coriaceous and shining, lanceolate, acute, concealed within the closed glumes. Inner palea oblong, concave, acute. Lodicules lanceolate, transparent, pointed, inflated at base. Stamens three; filaments capillary; anthers oblong, notched at each end. Ovary ovate. Styles two, slender. Stigmas hairy.

Species. *P. canariensis*, 11.

DIGRAPHIS. Panicle interrupted. Florets one. Glumes four, unequal, third and fourth reduced to hairy scales, first and second nearly equal, boat-shaped, keel without wings. Outer palea coriaceous and glossy, lanceolate, acute, concealed within the closed glumes. Inner palea oblong, concave, acute. Lodicules lanceolate, transparent, pointed; inflated at base. Stamens three; filaments capillary; anthers oblong, notched at each end. Ovary ovate. Styles two, slender. Stigmas hairy.

Digraphis arundinacea.
Floret. For Spikelet see p. 95.

Species. *D. arundinacea*, 12.

ANTHOXANTHUM. Panicle short, spike-like, narrow. Spikelets narrow and stalked. Florets one. Glumes four; first and second unequal, herbaceous; third and fourth narrower, hairy, one awned on the back, the other awned on the base. Outer palea short; inner palea like a scale. Lodicules none. Stamens two. Styles long. Stigmas filiform. Grain not grooved, pointed at both ends and adherent to paleæ.

Anthoxanthum odoratum.
Floret. For Spikelet see p. 76.

Species. *A. odoratum*, 10

HIEROCHLOE. Panicle more or less spreading. Spikelets glossy. Florets three, uppermost perfect, others male only. Glumes four, nearly equal. Outer glumes ovate, acute, keeled; inner ovate; all membranous, awnless or with short awns. Stamens three in the male florets, two only in the perfect floret; anthers linear, pendulous, notched at both ends. Ovary present only in uppermost floret, small ovate. Styles near together. Stigmas long, linear, downy. Grain ovate, pointed, small, not adherent to outer palea.

Hierochloe borealis.
Floret. For Spikelet see p. 102.

Species. *H. borealis,*

CHAPTER VII.

THE GENERA AND THEIR SPECIES.

THESE are arranged alphabetically for ease in reference; the systematic order has been given in the preceding chapter. The numbers are those previously adopted

AGROPYRUM. Plate xviii. *HORDEÆ.*

56. *repens* 36 in. COUCH GRASS. Root creeping; awn of outer palea short or absent; leaves generally smooth below.

57. *caninum* 24 in. BEARDED WHEAT GRASS. Root not creeping; awn of outer palea long; leaves generally rough below.

56 *A. repens.* Fields in the Northern Hemisphere. Flowers in June and July. Root perennial; rootstock long, yellow, smooth, extensively creeping and branching, with sheathing rudimentary leaves at the joints. Stems numerous, erect or ascending, stiff, leafy below, round and striated above. Leaves rolled in bud, narrow, tapering, thin, rough above and on edges, occasionally glabrous, auricled, spreading horizontally generally in one direction, ribs low and hairy. Sheath close ribbed, shorter than leaves; ligule short, apex finely toothed. Spike erect, flat, rather close; rachis angular and bristly on the angles. Spikelets

Agropyrum repens.
Spikelet. For Floret see p. 60.

elliptical in two opposite rows; florets four or more. Glumes pointed or slightly awned, edges next to rachis, ribs five or more. Outer palea shorter than glumes, ribs fewer and not so prominent, smooth, generally pointed, occasionally awned; inner palea awnless, with two green marginal ribs.

Varieties—

A. barbatum. Glumes awlshaped or awned, paleæ long awned.

A. obtusum. Glumes obtuse; paleæ obtuse and pointed.

A. pungens. Rachis nearly smooth; leaves involute; ribs rough; stem erect.

A. acutum. Rachis nearly smooth, leaves involute; ribs rough; stem prostrate.

A. junceum. Glume with nine or more slender ribs, thickly haired above, spikes articulate, spikelets obtuse and awnless. Leaves involute.

This is a common species, too common in cultivated soil owing to its extensively spreading roots. It is eaten by cats and dogs as an emetic, is much liked by pigs, and, in famines, its flour has been made into bread. Left to itself it is about a foot high, but it will clamber up in a hedge until it reaches three feet or perhaps more, where it can generally be recognised by its habit of turning its leaves to one side. In poor pastures, when young, it is not a bad fodder grass, and its variety, *A. junceum*, is of some use as a sandbinder, but it is by no means popular amongst farmers, owing to the trouble given by its runners.

57. *A. caninum.* An inhabitant of damp, shady woods in the Northern Hemisphere. June and July. Root perennial, not creeping, fibres downy and stout. Stems tufted, slender, striated, smooth, leafy; nodes numerous. Leaves auricled, tapering, thin, flat, rough on both sides, occasionally glabrous, almost upright. Sheaths shorter than leaves, lower sheaths hairy; ligule very small. Spike close, seldom quite erect; rachis angular and bristly. Spikelets in two rows, oval, alternate above, frequently in pairs below, florets five or fewer. Glumes, edges next to rachis, nearly equal, thin, hairy, ribs three, awned. Outer

palea longer than glumes, smooth, rough at apex, ribs five, a long, rough, slender awn projecting from apex; inner palea fringed, and having two green marginal ribs.

As the term "node" has not been defined so far as we have gone, it should be said that by it the joint itself is meant. In some books the interval between joint and joint is also called a joint. To avoid this the joints are herein called nodes—the correct term—and the intervals internodes. There are really two kinds of nodes, those of the stem itself and those of the sheath, but in these descriptions the distinction is immaterial.

AGROSTIS. Plate ix. *AGROSTIDEÆ.*

Awnless.

26. *alba* 24 in. FIORIN. Leaves rolled or flat.

Awned.

27. *canina* 12 in. BENT. Radical leaves setiform; panicle branches long; awn from below middle of keel.

28. *setacea* 24 in. BRISTLE BENT. Radical leaves setiform; panicle branches short; awn from base of keel.

29. *spica-venti* 36 in. SILKY BENT. Leaves all flat; panicle branches long; awn from above middle of keel.

26. *A. alba.* Pastures and fields; ranging almost everywhere north and south of the Tropics, even within the Arctic circle. July and August. Root perennial, creeping, reaching a foot in depth. Stem frequently procumbent at first rooting from lower nodes, then erect, smooth, striated; nodes smooth. Leaves flat or rolled, short, rather broad, thin, ribbed, ridges prominent, rough. Sheaths rough, striated, colourless; ligule longer than

Agrostis alba.
Spikelet. For Floret see p. 46.

broad, white, thin, hairy on back, edges toothed, apex pointed. Panicle spreading but compact after flowering, branches half-whorled. Spikelets erect, small, numerous, with one floret. Glumes thin, transparent, nearly equal, outer the longer, narrow, not ribbed, bristles along keel. Outer palea thin, ovate, notched, not ribbed, white with tuft of hairs at base ; inner palea half as long as outer palea, notched at apex, transparent.

Varieties—

A. stolonifera 24 in. Ligule long ; panicle contracted.
A. vulgaris 24 in. Ligule short ; panicle spreading.
A. pumila 4 in. Ligule short and obtuse ; panicle inclined.

This is mainly known by its variety *A. stolonifera*, a good fodder grass for moist lands on which it thrives even when floating in water. Its manner of growth has been compared to that of the strawberry, and when it flourishes its roots spread like couch and go five feet deep, though they are of little use to it when drought comes. It is most nutritious when it ripens, and of no use for hay unless haymaking is late. Its long, yellow, grooved seed is small—Sinclair says there are 81,805,680 to the bushel, and that the bushel weighs a quarter of a hundred-weight—and the seedlings grow thickly, thirteen of them to the square inch.

27. *A. canina*. Pastures and fields, ranging throughout the Northern Hemisphere between the Tropics and the Arctic circle. June and July. Root perennial, creeping, with trailing leafy shoots, fibres downy. Stem frequently procumbent at first, rooting at nodes, then erect, smooth, slender ; nodes smooth. Leaves of stem narrow, tapering, and toothed, ridges prominent ; radical leaves setiform, that is bristle-shaped, in tufts. Sheaths striated, smooth, colourless ; ligule longer than broad, white, thin, hairy on back, edges toothed, apex acute. Panicle spreading only in flower ; branches long, angular, rough, slender, brown. Spikelets numerous and pointed. Glumes unequal, long, and pointed, the outer the larger, with a toothed keel. Outer palea ribbed, punctate, toothed at apex, hairy at base, with a jointed incurved awn from below the middle of the keel ; inner palea minute or absent.

This is of no value as an agricultural grass. There is a variety known as *A. fasciculatis*, the shoots of which with leaves in tufts run along over the rest of the herbage in autumn, and are left alone by the cattle who eat the grasses around. It is common on poor light soils that have been long under pasture. Another variety, *A. capillaris*, grows in detached patches on heaths and moors.

28. *A. setacea.* Heaths, ranging through Western Europe, south of the Thames. July and August. Root perennial, tufted, fibres long, woody and downy. Stem erect, slender, striated, frequently rough; nodes three in number. Radical leaves like bristles, stem leaves prominently ridged, rough, narrow, glaucous. Sheaths long, striated, rough, uppermost longer than leaf, colourless; ligule rather short. Panicle close or spreading in short, slender half-whorled branches, rough and angular. Spikelets pointed, small, purple. Glumes nearly equal, outer the longer, lanceolate, toothed on keel. Outer palea shorter than glumes, ribbed, edges folded, toothed at apex, hairy at base, long awn from base and a short awn from each tooth of the apex; inner palea minute, with a tuft of hairs at base. Anthers purple and prominent.

29. *A. spica-venti.* Sandy fields, maritime counties of England from Yorkshire to Hampshire, its range being from Southern Europe and Temperate Asia to the Arctic Circle. July and August. Root annual, fibres thick and whorled. Stems erect, unbranched, slender, leafy; nodes near base. Leaves flat, ribbed, ridges prominent, narrow, pointed, rough beneath, spreading. Sheaths long, smooth, ribbed, colourless; ligule long, tapering, jagged. Panicle compound, spreading, one-sided, silky; branches alternate, angular and rough. Spikelets minute, glittering. Glumes unequal, outer the larger, narrow, pointed. Outer palea lanceolate, 3-ribbed, punctate, hairy at base, notched at apex, near which rises a very long straight awn; inner palea narrow, a tuft of hair on each side, notched at apex, awnless.

Variety—

A. interrupta 36 in. Panicle not spreading, spikelets crowded,

AIRA. Plates xii. and xiii. *AVENEÆ*.

36. *cæspitosa* 42 in. TUFTED HAIR GRASS. Panicle spreading; ligule long and pointed; leaves rough downwards; awn hardly longer than palea.

37. *flexuosa* 12. in WAVY HAIR GRASS. Panicle spreading and wavy; ligule short and truncate.

38. *canescens* 10 in. GREY HAIR GRASS. Panicle close; awn club-shaped.

39. *præcox* 6 in. EARLY HAIR GRASS. Panicle close; ligule long, sheathing, and torn.

40. *caryophyllea* 12 in. HAIR GRASS. Panicle spreading; ligule ong and pointed; sheaths rough upwards; awn twice as long as palea.

36. *A. cæspitosa*. Pastures and shady wet places, ranging through the Temperate and mountainous regions of the Northern Hemisphere. July and August. Root perennial, fibrous, densely tufted. Stem decumbent, then erect, leafy, rough. Leaves linear, striped white and green when held to light, rigid, cartilaginous; ribs dark green, thick and prominent, each with a line of hairs along its edge; blades rough downwards, margins rough, apex acute. Sheaths ribbed, uppermost longer than leaf; ligule long, acute, and torn. Panicle pyramidal, large, diffuse, glossy; branches rough and slender. Spikelets numerous, erect, small, silvery; two florets. Glumes nearly equal, upper glume ribbed, lower not ribbed, keels rather rough. Outer palea shorter than glumes, lanceolate, apex toothed, five ribs, base hairy, awned from middle; awn slightly longer than palea; inner palea narrow, shorter than outer palea.

This tufted Hair Grass is found almost everywhere, but most frequently in clayey moist places. It is recognisable by its light, large, open panicle, rough, hard leaves and its habit of growing in tussocks, which, however, is not indulged in by its variety, *A. lutescens*. It is not an easy weed to get rid of, as when the tussock is destroyed a plentiful growth of young shoots

will rise from the ring of roots around, and the only effectual way is to turn the ground and drain off the water. In many works it appears under the name of *Deschampsia cæspitosa*.

Variety—

A. alpina 24 in. Leaves short, glumes large, awn from middle.

37. *A. flexuosa*. Heaths and hilly pastures throughout the Northern Hemisphere and also in South America. June and July. Root perennial, fibres whitish and woolly in sand. Stems in loose tufts, compressed, slender, smooth, leafless above; nodes three. Radical leaves tufted, bristle-shaped, channelled or folded, nearly smooth; stem leaves narrow and rough. Sheaths long, close, rough near tips, uppermost longer than leaf; ligule prominent, short, cleft. Panicle loose, flexuose, angular, roughish, reddish. Spikelets glossy, florets two, red and white. Glumes nearly equal, pointed, lanceolate, rib not reaching apex, edges membranous, base purple. Outer palea equal in length to glumes, hairy at base, four teeth at apex, four ribs, awned from near base, awn bent and twisted; inner palea as long as outer palea, thin, pointed, edges fringed.

Varieties—

A. montana 24 in. Glumes large and purple.

A. setacea 24 in. Stem leaves bristle-shaped.

38. *A. canescens*. Sandy fields of East Anglia and the Channel Islands, ranging through Europe and Northern Asia. July and August. Stem slender, erect, often geniculate at base, leafy below, with several nodes. Leaves tufted, bristle-shaped, with short, rigid, grey hairs, glaucous. Sheaths ribbed, rough, uppermost embracing base of panicle; ligule lanceolate, decurrent. Panicle rather dense, spreading only during flowering, branches short, purplish. Spikelets numerous, crowded, small, variegated, purple, white and green, florets two. Glumes unequal, lanceolate, pointed, keel toothed. Outer palea shorter than glumes, acute, thin, smooth, keeled, hairy at base, bifid, awned, awn inserted at a little above the base, long, jointed, lower half

twisted, upper half straight and club-shaped ; inner palea shorter than outer, thin, cleft at apex. Anthers short and dark purple.

39. *A. præcox.* Sandy and hilly pastures of Europe and Western Asia. May and June. Root annual, fibres filiform. Stem erect, frequently geniculate below, tumid at nodes, angular above. Radical leaves none, stem leaves bristle-shaped, short, nearly erect, pale green. Sheaths angular, smooth, tumid, ribbed, uppermost longer than leaf ; ligule large, lanceolate, sheathing, torn or notched. Panicle spike-like, erect, narrow, branches angular, short and waved. Spikelets few, crowded, ovate, glabrous, hairy at base, florets two, silvery grey. Glumes equal, ovate, embracing paleæ, compressed, not rounded at base, awnless. Outer palea lanceolate, concave, awned on back near base, awn twice as long as palea, twisted and slightly kneed ; inner palea shorter than outer, margins inflexed, apex bifid.

40. *A. caryophyllea.* Sandy pastures and heaths, Europe and Western Asia. June and July. Root annual, small and fibrous. Stem erect, smooth, slender, leafy, ribbed ; nodes smooth. Radical leaves none ; stem leaves few, bristle-shaped, involute channelled, pale green. Sheath angular, striated, rough upwards ; ligule prominent, long and pointed. Panicle loose and spreading, branching in threes, rather wavy, purplish. Spikelets crowded, small, tumid, rounded at base ; florets two, hairy at base, purple, green, and white. Glumes equal, longer than florets, embracing paleæ, lanceolate, ribbed, jagged at apex, keel toothed. Outer palea smaller than glumes, acute, toothed at apex, hairy at base, ribless, awned ; awn jointed, long, and rough, rising from below middle and protruding beyond glumes ; inner palea almost as long as outer, flat, toothed at apex.

Aira caryophyllea.
Spikelet. For Floret see p. 48.

ALOPECURUS. Plate vii. *AGROSTIDEÆ.*

18. *agrestis* 24 in. SLENDER FOXTAIL. Spike tapering; stem rough.

19. *pratensis* 24 in. MEADOW FOXTAIL. Spike fusiform; stem smooth and straight; awn twice as long as palea.

20. *geniculatus* 12 in. MARSH FOXTAIL. Spike fusiform; stem smooth and kneed.

21. *alpinus* 18 in. ALPINE FOXTAIL. Spike cylindrical; stem smooth and straight; awn about as long as palea.

18. *A. agrestis.* Pastures; Europe and Russian Asia. April to October. Root annual, fibrous, small. Stem leafy, bare above, rather rough. Leaves acute, flat, striated, roug above, ribs prominent, rounded or acute below. Sheaths rough, tumid, uppermost longer than leaf; ligule lanceolate, downy. Spike erect, slender, tapering, purplish. Spikelets few, glabrous, one floret. Glumes nearly equal, united to middle, acute, ribs prominent, base hairy, keel downy, awnless, white and green. Outer palea ovate, half as long as awn and with two green ribs; inner palea absent.

Alopecurus agrestis.
Spikelet. For Floret see p. 44.

Slender Foxtail, otherwise Black Bent, is of no agricultural value, but a troublesome weed among cereals, particularly prevalent on poor soils. It is avoided by cattle, though its seed is eaten by pheasants, partridges, and smaller birds.

19. *A. pratensis.* Pastures, thriving on clay; Europe and Central and Northern Asia. April to June. Root perennial, reaching fourteen inches in depth, fibrous, creeping, prostrate

stolons rooting at intervals. Stem erect, smooth, striated; nodes smooth. Leaves rolled in bud, bases of radical leaves purplish, stem leaves dark green, roughish; ribs of upper surface prominent and flat. Sheaths smooth, longer than leaf, uppermost twice as long as leaf, rather loose; underground sheaths purplish; ligule thick, shorter than broad, blunt, hairy on back. Spike silvery grey, dense and fusiform, apex pointed, base obtuse. Spikelets flat, elliptical, crowded, overlapping, numerous, with one floret. Glumes equal, acute, slightly joined at base, hairy on keel, awnless. Outer palea smaller than glumes, two green ribs on each side, awned from middle of back, awn silky, bent, very long; inner palea generally absent, and when present sometimes awned. Anthers long and rosy.

Meadow Foxtail is the only valuable agricultural grass of the genus. It possesses quality, quantity, and earliness, and is most productive on clay and loamy soils. In many pastures it is the principal grass, its herbage being so abundant in proportion to its stalk. It is good as pasture and as hay, and yields an excellent aftermath. It does well in wet meadows, thrives under irrigation, perishes when there is no drainage, and though hardly touched by frost, rots at the roots when beaten down by much rain. As ripening diminishes its bulk it is cut when in flower. The seed, greyish brown, darker on one side, is very light. Sinclair found that a bushel of it weighed only 12 pounds, and calculated that there were 3,724,380 seeds to each bushel. Nearly two-thirds of the grain is eaten by insects, and to save this it is generally collected early in the year. It was one of the first seeds to be sown for pasture purposes by the British farmer.

20. *A. geniculatus*. Ditches, pools and swampy places in Europe and Temperate Asia. June to September. Root perennial, fibres long. Stem decumbent, then erect, bent at nodes, striated, smooth, leafy, branched, occasionally bulbous; nodes smooth. Leaves broad, flat, roughish, pointed, ribs prominent and acute. Sheaths long, smooth, and slightly tumid; ligule thin and oblong. Spike fusiform, dense, purplish, under two inches in length. Spikelets ovate, compressed, numerous, with one

floret. Glumes equal, blunt, joined at base, ovate, keel fringed. Outer palea shorter than glumes, with two green ribs, notched, half as long as the awn which projects from near the base; inner palea absent. Anthers large, thick, orange.

Varieties—

A. fulvus Awn short.
A. bulbosus Stems bulbous at base.

21. *A. alpinus*. Scottish mountains; a plant of the Arctic regions, unknown in Scandinavia, but found in Southern Chile. Root perennial, somewhat creeping, with many long fibres, root-stock oblique. Stem bending at the lowest node, then erect, leafy, smooth. Radical leaves linear, stem leaves two in number, broad and short, smooth, ridged, edges rough. Sheaths long, smooth, loose, pale red; ligule short and obtuse. Spike ovoid, about half as long as broad, and less than an inch in length. Spikelets erect, numerous, imbricated, having one floret. Glumes equal, joined at base, three ribs, clothed with soft white hairs, awn slightly protruding. Outer palea ovate, acute, folded, keeled, with a green rib on each side and frequently awned; inner palea absent.

ANTHOXANTHUM. Plate iv. *PHALARIDEÆ*.

10. *odoratum* 18 in. VERNAL GRASS. Four glumes and only two stamens.

Pastures; ranging throughout Europe and Asia, north of the Himalaya. April to July. Root perennial, shallow, fibrous, tufted, not creeping. Stems numerous, bending at the widely separated nodes, smooth and slender. Leaves few, flat, rolled in bud, short, tapering from near the point, ribs bearded. Sheaths hairy, smooth, ribbed; ligule thick, broad and hairy. Spike oblong, compact, slightly expanding as the seed ripens. Spikelets clustered, lanceolate, with one perfect middle floret and two outer and larger barren florets. Glumes four, unequal, brown tipped with white, hairy, outer of upper pair half as long as inner, with a single dorsal rib and awned, awn twisted and bent; inner of upper

pair with three ribs and awned, awn twisted and straight, margins turned in, enclosing the floret. Outer palea of barren florets awned from base, inner awned from the back. Paleæ of middle floret glabrous, shorter than those of the barren florets, equal in length but the outer larger and deeper than the inner. Stamens two.

Anthoxanthum odoratum.
Spikelet. For Floret see p. 63.

Variety—

A. puelii. Slender, stems numerous, branching from base; awn long.

Vernal Grass is a hardy perennial coming into flower in April and growing till late in the autumn. It has a strong scent of new-mown hay, and though cut for hay is really worth more as pasture. The aftermath is more valuable than the first crop. It does better with other grasses than by itself, thriving in deep, moist soils and marshy places, becoming reed-like where the conditions are suitable. It does well under the shade of trees and will live in thin soils which no other grass will endure; and it is said to discourage the growth of moss. All fertilisers are wasted on it. Sinclair calculated that there are 37,156,680 of its brown, glossy, ungrooved seeds to the bushel, which weighs 49 pounds, and that its young plants grow five to the square inch. In woods its anthers are said to be always purple, in meadows yellow, but there are evidently exceptions. Its name, the yellow-flowered, is fully justified, for as a rule the inflorescence is noticeably yellower than that of most of our grasses. Its reputation as a profitable grass is very different to what it used to be, and in seed mixtures now sold for laying pastures it is either represented by an insignificant quantity or omitted altogether. The anthers, unlike those of many grasses, open for a time above the stigmas, thus insuring self-fertilisation, and then sink below hem.

ARRHENATHERUM. Plate xv. *AVENEÆ.*

44. *avenaceum* 42 in. FALSE OAT. Spikelets large ; florets two ; lower floret male.

Fields and shady waysides throughout Europe and Western Asia. June and July. Root perennial, loosely tufted, rootstock extensively creeping, deeply penetrating, with two swollen joints, one frequently resembling a bulb. Stem erect, smooth, brittle ; nodes generally smooth. Leaves dark green, acute, keeled, thin, dry, drooping, ribs on upper surface, low and flat, fourth and fifth stronger than the others. Sheath keeled, smooth ; ligule conspicuous, obtuse, jagged, hairy on back. Panicle loose, narrow, half-whorled, branches all one way, spreading only while florets are open. Spikelets with two florets, large, laterally compressed, hairy at base, upper floret perfect, lower floret barren. Glumes pale green, unequal, outer glume the shorter, smooth, pointed, thin. Outer palea of lower floret acute, rough, ribbed, midrib with awn rising from above the base, twice as long as the spikelet, bent and twisted at the apex of the palea. Outer palea of upper floret with awn from the point, small or absent. Anthers large, pendulous, and purple.

Arrhenatherum avenaceum.
Spikelet. For Floret, see p. 49.

The False Oat is a rather uncertain perennial of rapid growth, recognisable by the large spikelets and the disclosing of the violet paleæ by the wide, gaping, yellowish green glumes. Though not much liked by horses it is a good hay and pasture grass, yielding a satisfactory aftermath, and valuable when cut in flower in warm, dry weather. It has to be mixed with other species to thrive, and though somewhat indifferent to climate or soil, is at its best in a warm region in good, light, medium ground. The pale-brown seed is best sown in autumn, and has to be sown more deeply than that of any other grass.

ARUNDO. Plate xxxiii. *FESTUCEÆ.*

101. *phragmites* 10 ft. REED. Panicle brown and silky.

Banks of streams; range world-wide. July and August in the Northern Hemisphere. Root perennial, stoloniferous, extensively creeping. Stem simple or branched, geniculate or straight, leafy; nodes numerous and smooth. Leaves lanceolate, somewhat unilateral, firm, flat, transversely wrinkled, points frequently split, keeled at base. Sheaths round, overlapping, shorter than leaves, deeply split; ligule a tuft of erect hairs. Panicle erect, diffuse, branches alternate, fasciculate, compound, lower branches with long, white, silky hairs, rachis angular. Spikelets numerous, imbricated, linear-lanceolate, florets three or six, hairy, awnless. Glumes unequal, inner twice as long as outer, concave, acute, ribbed, keeled. Outer palea lanceolate, thrice as long as inner palea, pointed, smooth, edges involute, ribs three; inner palea short, linear, flat, fringed towards apex, margins involute and purplish.

Arundo phragmites.
Spikelet. For Floret see p. 52.

The Reed with its chocolate florets is familiar to all, growing where no other useful plant will grow, flourishing in mud with perhaps a foot of water over its roots, and averaging perhaps six feet in height, though occasionally reaching as much as twelve. In the fens it grows in extensive patches known as reed-ronds, and similar tracts occur in many parts of Europe, notably on the Danube, where, as elsewhere, they form happy hunting grounds for the ornithologist

AVENA. Plate xiv. *AVENEÆ.*

41. *fatua* 36 in. WILD OAT. Spikelets drooping; ligule short.

42. *pratensis* 18 in. PERENNIAL OAT. Spikelets erect; ligule pointed.

43. *flavescens* 24 in. YELLOW OAT. Spikelets erect; ligule truncate.

41. *A. fatua* Cornfields everywhere. June and July. Root annual, small, thickened at base, whorled, fibres downy. Stem erect, striated, smooth, glossy. Leaves linear, thin, broad, flaccid, basal margin not rough upwards, ribs low and flat, third, fourth, and fifth the strongest, apex acute. Sheaths thin, keeled, edges frequently filamentous; ligule short, obtuse, hairy on back. Panicle loose, large, at first unilateral then spreading, much branched, branches alternate, thickened towards apex, nodding. Spikelets loose, drooping or pendulous, florets many, with fulvous hairs at base. Glumes equal, thin, acute, ribs eight, each with a double line of scabrous points. Outer palea thick, ovate, bifid at apex, dark brown, with yellow hairs at base, ribs less than eight, back rounded and bristly, with an awn below the middle twice as long as glumes, jointed, twisted at lower end and then bent and straightened; inner palea shorter than outer, ovate-lanceolate, ribbed along margin.

Variety—

A. strigosa 30 in. Glumes large, hairy on lower half; apex bifid and pointed.

This plant affords a noteworthy instance of the limitations of popular metaphor. Sowing wild oats is a phrase that does not appeal to the botanist, for wild oats are very beautiful, and from the wild oats by persistent collection and sowing came the edible and profitable species, *A. sativa*, the food of horses and men. Further, one of our writers on grasses, Miss Plues, recommends wild oats for a lady's bouquet! The grain of the oat, like that of all the genus, has compound starch grains, thereby distinguishing it, microscopically, from that of our other cereals

42. *A. pratensis* Chalk meadows and other dry pastures of Europe and Russian Asia. July and August. Roots perennial, tufted and slightly creeping, fibrous, downy. Stem erect, simple, rigid, striated, roughish. Leaves mostly radical, stiff, linear, thick, short, narrow, edges rough, hooded at apex.

Avena pratensis.
Spikelet. For Floret see p. 49.

Sheaths stiff and elastic; ligule lanceolate and pointed. Panicle compact, not spreading in bloom, erect, long; branches rough, slender. Spikelets few, large, oval, upper ones nearly sessile, florets from three to six. Glumes unequal, outer the smaller, acute, three-ribbed, keeled, purple at base. Outer palea acute, rough on keel, hairy at base, cleft at apex, a long awn rising from centre of keel, stout and twisted below, then stiff and rough above, purplish and tipped with white; inner palea lightly fringed.

Varieties—

A. pubescens Leaves and sheaths downy; leaf-shoot flat.
A. planicularis Stems and sheaths flattened.

43. *A. flavescens.* Meadows and pastures, mainly in limestone districts, throughout Europe and Temperate Asia. June and July. Root perennial, creeping, somewhat stoloniferous, loosely tufted. Stem erect, curved at base, leafy, smooth; nodes downy. Leaves rolled in bud, linear, flat, flaccid, with twenty or more ribs, low and acute, a single row of hairs along each rib, pale green. Lower sheaths hairy, upper sheaths nearly smooth, no keel; ligule truncate, short, conspicuous, hairy on back. Panicle spreading when in bloom, much branched. Spikelets numerous, erect, small, florets three or four, golden and glossy. Rachilla with long, white hairs. Glumes unequal, acute, keeled, rough, larger with three ribs, smaller with one rib. Outer palea hairy at base, bifid and awned at apex, with five ribs, a short, slender, bent and twisted awn rising from centre of back; inner palea short, notched, narrow, edges inflexed.

The yellow oat is not without agricultural value for sheep and cattle. It does well on dry soils that are not too tenacious, marls and chalky pastures being the best. The first crop is poor, but

the aftermath is profitable. It thrives among Meadow Barley, Crested Dog's-tail, and Vernal Grass, particularly where there is no shelter, but is a failure when tried by itself. The seed is pale brownish yellow, very small and light, difficult to obtain pure, and germinates badly except when sown in autumn.

BRACHYPODIUM. Plate xix. *FESTUCEÆ.*

60. *sylvaticum* 24 in. SLENDER FALSE BROME. Spikelets generally drooping; leaves flaccid and drooping; ligule longer than broad.

61. *pinnatum* 24 in. HEATH FALSE BROME. Spikelets generally erect; leaves firm and erect; ligule broader than long.

60. *B. sylvaticum*. Shady thickets and woods of Europe and Central Asia. June and July. Root perennial, fibrous, tufted. Stem slender, tapering, unbranched, leafy, arching; nodes four, hairy. Leaves reversed and tapering at base, flat, broadly linear, pointed, ribbed, hairy, rough, flaccid. Sheaths close, ribbed, hairs deflexed, uppermost shorter than leaf; ligule longer than broad, triangular, apex toothed. Spike loose, drooping; rachis wavy, not notched. Spikelet nearly sessile, an inch in length, cylindrical, slender, alternate, more or less unilateral, distant; florets eight or more. Glumes unequal, ribbed, lanceolate, downy, shorter than paleæ, pointed or awned, edges next to rachis. Outer palea ribbed, hairy, narrow, apex awned, awn longer than palea; inner palea blunt, fringed, overlapping two stamens and the ovary, and leaving the third stamen free.

Brachypodium sylvaticum.
Spikelet. For Floret see p. 58.

The inflorescence of *Brachypodium*, spike-like though it appears,

is really a simple raceme with very short pedicels. The two British species, *B. sylvaticum* with nodding racemes, and *B. pinnatum* with upright racemes, are of very wide distribution. *B. sylvaticum* attains a considerable height, clambering among bushes, flourishing in the shade, but when not helped in this way out in the open, and particularly in stony places near the sea, it is much shorter. It is of solitary growth, and remains green during the winter. Cattle, sheep, and horses do not touch it, but deer seem to have no objection to it—when they can get little else. Its leaves are reversed at the base, so that the upper side is really the under side.

61. *B. pinnatum.* Heaths in the chalky districts of Europe, and in Central Asia. July and August. Root perennial, scaly, slightly creeping. Stem erect, rigid, unbranched, smooth, leafy ; nodes four, hairy. Leaves tapering at base, lanceolate, pointed, ascending, hairy, ribs low, midrib prominent. Sheaths glossy, smooth, lower with drooping hairs ; ligule short, blunt, hairy. Spike erect, smooth, alternate. Spikelet nearly sessile, erect, florets seven or more ; rachis rough, smoothly grooved. Glumes unequal, oval, ribbed, awned, edges next to rachis. Outer palea broad, longer than outer glume, ribs five, awn short ; inner palea shorter than outer, upper half with two green ribs, edges inflexed.

BRIZA. Plate XXV. *FESTUCEÆ.*

77. *media*	15 in.	QUAKE GRASS. Stem smooth ; ligule short.
78. *minor*	12 in.	LESSER QUAKE GRASS. Stem rough ; ligule long.

77. *B. media* Downs and pastures, ranging through Europe and Russian Asia. June and July. Root perennial, fibres thick and branched, slightly creeping. Stem erect, round, slender, smooth, striated, glossy. Leaves erect, linear, flat, acute, roughish above, margins rough. Sheaths ribbed, long, but shorter

than internodes, uppermost longest; ligule short, sheathing, truncate. Panicle erect, triangular, wide spreading, branches filiform, long, distant, paired. Spikelets ovoid, smooth, glossy, pendulous, florets about seven, imbricated, sessile, green and purple. Glumes nearly equal, glabrous, concave, blunt, slightly keeled, outer with three ribs, inner with five ribs. Outer palea smooth, broad, blunt, ribbed, concave, border membranous; inner palea membranous, a green rib on each side.

Quake Grass is interesting as possessing the rudiment of a posterior style. It is best appreciated as an ornament, but its nutritive qualities are considerable, and it is freely eaten by horses, cows, and sheep. Poor, tenacious ground suits it best, and it thrives as a sort of advance guard on rocky, shallow soil, where its graceful, pendulous spikelets are frequently the only flowers. It was from the drooping, balancing habit of the inflorescence that its name, *Briza*, was given to it. It has an easily recognisable seed, ovoid and dark brown.

78. *B. minor*. Fields and wastes in the south of England and Ireland; ranging through Southern and Western Europe. May and June. Root annual, small, tufted, fibres compressed. Stem erect, striated, rough to the touch; nodes five. Leaves erect, short, broad, tapering, glabrous, margins and keel rough, sheathing. Sheaths open, striated, smooth, uppermost rather longer than leaf; ligule long, thin, white, decurrent, embracing stem. Panicle widely spreading, roundish, branches filiform, distant, and paired. Spikelets ovoid, smooth, pendulous, florets five or more. Glumes nearly equal, concave, blunt, outer with three ribs, inner with five ribs. Outer palea smaller than glumes, deep, concave, lobed, rough, three-ribbed; inner palea thin, flat, concealed in outer palea.

Briza minor.
Spikelet. For Floret see p. 54.

BROMUS. Plates xx. and xxi. *FESTUCEÆ.*

Panicle erect or inclined—

65. *maximus* 30 in. GREAT BROME. Florets lanceolate, rachis downy ; florets with conical point at base.

67. *arvensis* 15 in. FIELD BROME. Florets oblong and turgid, rachis rough, lower branches whorled.

62. *erectus* 30 in. UPRIGHT BROME. Florets lanceolate, rachis rough, lower branches in threes.

66. *madritensis* 12 in. COMPACT BROME. Florets lanceolate ; rachis rough, lower branches in pairs.

Panicle drooping.

63. *asper* 72 in. HAIRY BROME. Awn shorter than floret and straight, sheath rough.

64. *sterilis* 30 in. BARREN BROME. Awn longer than floret and straight, sheath pubescent.

68. *giganteus* 48 in. TALL BROME. Awn longer than floret, waved and twisted, sheath glabrous.

62. *B. erectus.* Sandy fields and chalky soils of Temperate and Southern Europe. July and August. Root perennial, tufted, black, slightly creeping, fibres long and branching. Stems several, erect, rigid, striated ; nodes downy. Leaves folded in bud at base, linear, fringed on edges, upper leaves broader, hairs erect, dark green. Sheaths almost entire, long, ribbed, hairs ascending ; ligule very short, truncate, torn. Panicle erect ; branches distant, half-whorled, nearly upright ; rachis rough. Spikelets linear, lanceolate, erect, compressed, florets four or more, remote, uppermost often imperfect, generally purple. Outer glume the larger, membranous, lanceolate, pointed, keeled, glabrous ; inner glume with three ribs. Outer palea with five ribs, second and fourth indistinct, lanceolate, cleft, keel toothed, flat above, incurved below, awned from below apex ; inner palea flat, awnless, a green rib on each side, edges inflexed. Anthers orange, large, fringed.

Variety—

B. villosus. Outer palea hairy.

The Upright Brome yields a fair amount of hay on chalky soils, but the greyish green radical leaves being long make it appear to give more herbage than is really the case. Its leaves come late, but the flowers are early. Cattle do not like it owing to its roughness. Its near ally, the introduced *B. inermis*, is a much more profitable grass, especially in dry climates.

63. *B. asper.* Woods and shady lanes, ranging through Europe and Northern Asia. July and August. Root annual or perennial, fibres thick and spreading. Stem tall, erect, smooth above, leafy; nodes numerous, rather hairy. Leaves tapering from base, auricled, constricted in middle, flat, thick, pointed, ribbed, hairs long and spreading, upper leaves narrow, deep green, keel white; lower leaves drooping. Sheaths almost entire, ribbed, rough, hairs long and deflexed, keel, a white line; ligule short and blunt. Panicle drooping, large, loose, rough, branches in pairs, a scale at their base. Spikelets an inch long, obliquely pendulous, compressed, florets four or more, purple. Glumes unequal, outer the shorter, with one rib, inner with three ribs, dorsal rib toothed, margins hairy. Outer palea longer than glumes, margins hairy, ribs five to seven, awned from just below bifid apex; inner palea shorter than outer, glabrous, keel fringed, margins inflexed. Stigmas not terminal.

64. *B. sterilis.* Sandy fields and waste places, ranging through Europe and Russian Asia. June to August. Root annual or biennial, small, creeping, fibres capillary. Stem erect from a curved or geniculate base, rough, striated, rooting from lower nodes, leafy above. Leaves linear, flat, spreading, ribbed, flaccid, downy, edges hairy. Sheaths almost entire, ribbed, angular, hairs deflexed, uppermost as long as leaf; ligule square and torn. Panicle nearly simple, loose, drooping, lower branches long and in pairs. Spikelets an inch or more long, lanceolate, rough, pendulous, florets six or more, purplish brown, Outer glume ribless, keel toothed on upper half; inner glume the larger, angular, ribs three. Outer palea slightly incurved,

longer than glumes, glabrous, ribs seven, rough on back and awned; inner palea shorter than outer with two green fringed marginal ribs. Styles lateral and short.

This handsome but useless grass is very local in fields, and consequently gives little trouble as a weed. It is heavy in crop owing to the large size of the panicle, but nearly all the nutritive value is in the stems and leaves when it flowers, and disappears from them as the seed ripens.

65. *B. maximus.* A Mediterranean species established in Jersey. June and July. Root annual, fibrous. Stem erect from a curved or geniculate base, leafy, downy; nodes four. Leaves flat, pointed, downy, margins rough. Sheaths almost entire, small, lower downy, upper ribbed; ligule prominent, square, torn. Panicle inclined, slightly branched, branches and rachis downy. Spikelets (including awns) three inches in length, florets eight, distant, rounded, with a sharp conical point at base. Glumes lanceolate, pointed, inner the larger. Outer palea larger than glumes, lanceolate, rough, bristles deflexed, ribs seven, with a very long awn from the bifid apex; inner palea shorter than outer, thin; fringed on folds. Stamens frequently only two in number.

66. *B. madritensis.* Rocks and walls and other dry places; ranging through Southern and Western Europe. June and July. Root annual, small, fibrous, Stem erect, geniculate, slender, stiff, smooth, striated, leafy; nodes three or thereabouts. Leaves flat, linear, pointed, hairy or downy on both sides. Sheaths ribbed, smooth, slightly keeled, split half-way, uppermost downy; ligule prominent, short and blunt. Panicle small, erect, rather close, tufted; rachis rough. Spikelets erect, linear-lanceolate, lower in pairs, peduncles short, florets about eight, purplish. Glumes unequal, inner the larger, three-ribbed, midrib toothed at apex. Outer palea longer than glumes, ribs seven, two lateral ribs close together, edged with thick hairs, cleft at apex, awn as long as palea; inner shorter than outer palea, linear-lanceolate.

Varieties—

B. diandrus.	Panicle erect; paleæ nearly equal.
B. rigidus.	Panicle compact; rachis downy.

67. *B. arvensis.* Ranging, mostly on clay soils, through Europe and Central Asia. June to August. Root annual or biennial, fibrous. Stems several, rooting from the lower nodes erect, slender, hard, striated, leafy; nodes four, hairy, covered by sheaths. Leaves narrow, flat, downy, ribbed, edges rough. Sheaths almost entire, keeled, hairs deflexed, shorter than leaves, uppermost small; ligule conspicuous, torn. Panicle erect, then drooping, spreading, rough, half-whorled. Spikelets lanceolate, glossy, drooping, florets seven or more, purple and white. Outer glume the smaller, five-ribbed; inner three-ribbed and often slightly awned. Outer palea short, ovate, turgid, cleft at apex, awn as long as glumes; inner palea shorter than outer palea, thin, white. Anthers yellow.

Varieties—

B. secalinus.	Panicle loose, drooping, slightly compound.
B. racemosus.	Panicle long, erect, simple, plant glabrous.
B. commutatus.	Panicle loose, slightly drooping, plant glabrous; stem with five joints.
B. mollis.	Panicle close, erect, plant downy, leaves rolled in bud
B. multiflorus.	Florets numerous, glumes broad.

The Field Brome has been formed into a genus or sub-genus of its own, of which its varieties form its species; but as we are following Bentham in our list we have to leave it as he left it. This new genus *Serrafalcus*, or as Hackel has it, sub-genus, *Zeobromus*, may be shortly described as consisting of annuals with ovate or lanceolate spikelets, narrower above; outer glume with three to five ribs, inner with five to seven; outer palea with seven to nine, without keel and occasionally awnless; inner

palea stiffly fringed with hairs. All the varieties are useful for hay. *B. mollis* is common on poor soils, as owing to its shallow root it can do with little food. It used to be sown amongst clover, being recommended for its early growth and large seeds, but is out of favour now. Its seed ripens before the hay harvest, and as it attains a fair size before the autumn, and stands frost well, it ranks as an early grass and is very difficult to get rid of. The grain of *B. secalinus* has been ground to flour with awkward results, owing to its being narcotic.

68. *B. giganteus*. Woods and shady waysides, ranging through Europe and Central Asia. June to August. Root perennial, loosely tufted, fibres long and downy. Stems numerous, erect, smooth, glossy, striated, stout, leafy; nodes tumid and purple. Leaves flat, narrow, tapering, constricted in middle, flaccid, rough, shining below, ribbed, keeled, eared at base, base purple. Sheaths long, striated, smooth, gaping slightly at apex, uppermost longer than leaf; ligule short, broad, truncate, high on one side. Panicle large, drooping, branches distant; rachis rough at its angles. Spikelets ovate, smooth, drooping, florets three or more, compressed. Outer glume green on back, single-ribbed; inner glume the larger, lanceolate, pointed, ribs three, edges white. Outer palea ovate-lanceolate, incurved, smooth, base bristly, keel nearly smooth, awn more than twice as long as palea; inner palea nearly equal to outer and slightly ciliated on the ribs. Styles terminal, ovary, glossy.

Bromus giganteus.
Spikelet. For Floret see p. 57.

Variety—

B. triflora. Panicle small and erect; florets three.

This grass is now generally placed in *Bromus*, but it is almost as well known under its older name of *Festuca gigantea*.

CALAMAGROSTIS. Plate xi. *AGROSTIDEÆ.*

32. *epigeios* 48 in. WOOD SMALLREED. Panicle close, hairs longer than paleæ.

33. *lanceolata* 48 in. PURPLE SMALLREED. Panicle loose, ligule decurrent.

34. *stricta* 36 in. NARROW SMALLREED. Panicle close, airs shorter than paleæ, spikelets small, glumes broad.

35. *strigosa* 24 in. MEAGRE SMALLREED. Panicle close, hairs shorter than paleæ, spikelets large, glumes acuminate.

32. *C. epigeios.* Marshy woods and shady places; chiefly in the South of England, ranging through Europe and Temperate Asia up to the Arctic Circle. June and July. Root perennial, rootstock slender, creeping, fibres few and whitish. Stem rough, just below the panicle, slender; nodes smooth. Radical leaves short, stem leaves long, ribbon-like, rough on keel and edges, narrow, glaucous below. Sheaths long, close, tapering, often involute; ligule lanceolate, torn, smooth on both sides. Panicle often nine inches in length, slender, lobed, spreading when in flower, branches half-whorled, rough, and purplish. Spikelets clustered unilaterally, pointed, nodding, brownish, glossy; one floret. Glumes nearly equal, narrow, tapering, points rough, keel rough. Outer palea shorter than glumes, white, hairy at base, notched at apex, awn straight, rising from middle of the back; inner palea small, thin, pointed.

Calamagrostis epigeios.
Spikelet. For Floret see p. 46.

33. *C. lanceolata.* Ditches, hedges, and marshy thickets in England, ranging through Central Europe and Russian Asia. June and July. Root perennial, creeping slightly, fibres woolly. Stem smooth, leafy, slender; nodes widely apart. Leaves

narrow, flat, pointed, flaccid, ribs unequal, light green below. Sheaths close, long, striated, uppermost longer than leaf; ligule lanceolate, torn, decurrent. Panicle loose, much branched, spreading when in flower. Spikelets erect, scattered, numerous; one floret. Glumes nearly equal, acute, lanceolate, keel toothed, bronzed. Outer palea shorter than glumes, thin, white, ribbed, cleft at apex, having a short rough awn from angle of cleft; inner palea thin, transparent, notched at apex.

34. *C. stricta.* Bogs (rare), ranging through the Northern regions of the Northern Hemisphere. June and July. Root perennial, creeping. Stem erect, slender, leafy; nodes smooth. Leaves rigid, narrow, pointed, rough above, two or three on a stem. Sheaths smooth, striated; ligule short, slightly notched. Panicle narrow, compact, spreading only when in flower, branches half-whorled, purple. Spikelets crowded, numerous, purplish brown, one floret, hairs longer than florets. Glumes nearly equal, thin, ovate, rough on back. Outer palea as long as glumes, ovate, notched, hairy at base, awned from below middle of back; inner palea shorter than outer, with a tuft of hairs and a bristle at its base.

Variety—

C. lapponica Hairs shorter than florets.

35. *C. strigosa.* North of Scotland; an Arctic and northerly species, in many ways resembling No. 34, but more slender in habit. Panicle close; spikelets large; glumes lanceolate, folding into a long point; outer palea shorter than glumes, jagged at apex, an awn rising from below middle of back; inner palea slender.

CATABROSA. Plate xxxi. *FESTUCEÆ.*

94. *aqualica* 36 in. WHORL GRASS. Panicle whorled.

Pools and slow running streams; ranging through the Northern Hemisphere. May and June. Root perennial, extensively creeping, fibres long, white, glossy, frequently floating. Stem pro-

cumbent or floating, then ascending, stout, smooth. Leaves flat, lanceolate, flaccid, folded in bud, rounded at base, blunt or bifid at apex, ribless with median lines, keeled, lower ones floating. Sheaths flat, smooth, striated, loose, ligule short, rounded or torn. Panicle erect, branches in threes or fives, unequal, half-whorled, spreading, angular. Spikelets numerous, pendulous, small, florets two or more. Glumes unequal, broad, truncate, thin, inner glume the larger, ribs three, purplish. Outer palea large, obtuse, notched at apex, ribs three; inner palea small, with two ribs, and enclosing stamens.

Catabrosa aquatica.
Spikelet. For Floret see p. 53.

Varieties—

C. littoralis. Leaves and sheaths small, only one floret.

C. minor. Under four inches in height; only one floret.

CYNODON. Plate XV. *CHLORIDEÆ.*

47. *dactylon* 8 in. DOG'S-TOOTH. Spikes digitate.

Sandy shores of south of England, a native of warm climates. July and September. Root perennial, tough, widely creeping, fibres smooth. Stem at first creeping, then erect, matted, geniculate, leafy; nodes smooth, all near the base. Leaves flat, involute, tapering, ribbed, rigid, blunt, hairy. Sheaths long, smooth, covering all the nodes; ligule a hairy tuft. Spikes purple, digitate, divergent, under two inches in length, and from three to five in number. Spikelets awnless, unilateral, alternate, with one floret. Glumes nearly equal, open, lanceolate,

Cynodon dactylon.
Spikelet. For Floret see p. 50.

acute, keel with teeth on upper part. Outer palea longer and broader than glume, compressed, glossy, smooth on sides, roughish on edges, ciliate on keel; inner palea long, narrow, edges rough.

There are four species of *Cynodon*, three of which are Australian. The fourth is this cosmopolitan Dog's-tooth, rare amongst us, but so much appreciated in India that the Hindoos celebrate its virtues in their writings. It is the Durba of Bengal, the Hariali of the Deccan, one of the commonest of Indian grasses, and the best for fattening and milk-producing powers. Its young leaves are eaten by the natives and its roots made into a cooling drink. Its turfing qualities are considerable owing to its rooting stolons and close growth, and it is much used for lawns. In the northern United States, under the name of Bermuda Grass, it is thought as highly of as in India, for although it grows best on sandy soils and has delicate leaves, it is not injured by protracted drought.

CYNOSURUS. Plate xxiv. *FESTUCEÆ.*

75. *cristatus* 24 in. CRESTED DOG'S-TAIL. Spike semi-cylindrical; glumes pointed.

76. *echinatus* 10 in. ROUGH DOG'S-TAIL. Spike pyriform; glumes awned.

Cynosurus cristatus.
Spikelet. For Floret see p. 55.

75. *C. cristatus.* Hilly pastures; ranging through Europe and Western Asia. July and August. Root perennial, tufted, occasionally stoloniferous, reaching nine inches in depth. Stems several, tufted, erect, smooth, wiry; nodes several. Base of radical leaves yellow, leaves folded in bud, then with overlapping edges, thin, narrow, flat, pointed, ribs prominent on upper surface, glossy below, bright green. Sheaths yellowish white near base, smooth, striated; ligule

short and auricled. Spike erect, stiff, unilateral; rachis wiry, angular. Spikelets ovate, flat, alternate, unilateral, with pectinate involucre of empty glumes, florets many. Rachilla flat at apex. Glumes unequal, shorter than palea, linear, keel rough, pointed. Outer palea opaque, ovate-lanceolate, rounded on back, keeled on upper half, five-ribbed, yellowish, pointed, point curving to one side; inner palea transparent, edges lightly fringed. Anthers purple.

The sheep that feed on Dog's-tail seldom have foot-rot. It is a good, but rather late, grazing grass, forming a dense turf and satisfactory feed. When in flower it is a favourite with cattle, sheep, and deer, but is valueless when the seed is ripe, and, owing also to its wiry stems, not suitable for hay. Though it thrives most on dry loams it is healthy everywhere; on light, chalky or gravelly ground it is used for giving a good "sole" to the pasture; and thanks to its deep roots it retains its vigour and vitality when other species wither in the drought.

76. *C. echinatus*. Channel Islands; ranging through Southern and Western Europe. June to August. Root annual, fibrous, downy. Stem ascending, striated, smooth, leafy, internodes short; nodes small. Leaves lanceolate, flaccid, ovate at base, flat, prominently ridged, pointed, rough on both sides. Sheaths rather tumid, furrowed; ligule lanceolate, auricled. Spike erect, simple, pyriform; rachis wiry, angular. Spikelets ovate, alternate, unilateral, with pectinate involucre of empty glumes; florets two to five. Glumes nearly equal, thin, keels rough, awned. Outer palea ovate-lanceolate, five-ribbed, awned, awn as long as palea; inner palea lightly fringed.

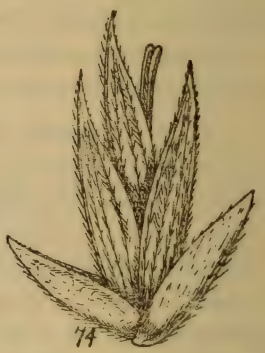
This species, which is fairly common on the Sandwich meadows, is most useful to the farmer when it dies to prepare the soil for a better grass.

DACTYLIS. Plate xxiv. *FESTUCEÆ*.

74. *glomerata* 36 in. COCK'S-FOOT. Panicle with few branches spikelets densely clustered.

Fields, pastures, orchards, and waste places throughout Europe and Central Asia. June to August. Root perennial, fibrous,

prominently tufted, fan-shaped, attaining twenty inches in depth. Stem erect, stout, hard. Leaves thick, broad, flat, shoot flat, folded in bud, tapering at outer end, keel prominent, ribless, without median lines, edges rough, shining below, apex acute, bluish green. Sheaths flat, rough downwards with acute edges, almost entire; ligule obtuse, torn, white, longer than broad. Panicle short, erect, spreading horizontally below when in flower, close, pointed above, alternately branched, branches tubercled at base; rachis rough. Spikelets ovoid, compressed, densely-clustered; florets three to five. Glumes unequal, shorter than florets, lanceolate. Keels hairy above and ending in a point. Outer palea long, toothed at apex, five-ribbed, keel hairy, awn curved; inner palea membranous, fringed at base, bifid at apex.



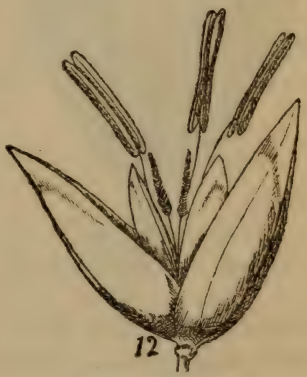
Dactylis glomerata.
Spikelet. For Floret see p. 55.

This is another of our native grasses disregarded by our farmers until the seed was exported here from America, in this case Virginia. It thrives best in moist places, even under trees where it suffers no damage from the shade or drippings, though it cannot stand shrubs. A coarse and hardy grass with a tall strong stem, growing in dense tufts, it is thus most nutritious in its youth, and gives better pasture than it does hay. Sturdy and healthy it is found everywhere, though noticeably dwarfish on limy land. In thin soils the fibrous roots have not hold enough to prevent them being drawn out of the ground by the cattle, to whom the plentiful foliage affords such an excellent grip; and it also suffers by being trodden on, especially in dry weather. Sinclair found that the yellowish fusiform seeds weighed 21 pounds to the bushel of 9,517,860 of them. It is the only representative of its genus. Its name of orchard-grass is due to its doing so well under trees, and its generic name, *Dactylis*, comes from the rounded, finger-tip shape of its inflorescence which is most apparent in woodland specimens.

DIGRAPHIS. Plate iv. *PHALARIDEÆ.*

12. *arundinacea* 48 in. REED GRASS. Panicle rosy or purple.

Sandy watersides, ranging throughout the Northern Hemisphere. July and August. Root perennial, tufted, with strong horizontal shoots becoming vertical. Stem erect, round, purplish at the nodes. Leaves lanceolate, rather broad, flat, ribbed, keeled, rough. Sheaths with edges overlapping, slightly tumid; ligule membranous, blunt, and decurrent. Panicle erect, branched, spreading, lobed, branches angular. Spikelets crowded, numerous, leaning to one side, greenish. Glumes four, lower pair not winged, nearly equal, keeled, rough, awnless. Outer palea ovate-lanceolate, smooth, glossy, ribless, awnless, fringed with long hairs, closely adherent to grain; inner palea shorter than outer. Stigmas filiform, protruding from apex of spikelet. Grain long and dark grey.



Digraphis arundinacea.
Spikelet. For Floret see p. 63.

The broad leaves and reedy stems are of some nutritive value, but, except when young, too coarse for cattle. In places it is cut and yields a good aftermath. In other places it is sown in marsh-land for the purpose of drying it, and effects this purpose so well that in four or five years it has converted a swampy waste into a fertile meadow. It does better on tenacious clay than on rich sandy loam. The striped variety is the Canary Grass of the garden.

ELYMUS. Plate xvi. *HORDEÆ.*

51. *arenarius* 48 in. LYME GRASS. Two spikelets in each notch; leaves broad.

Sandy shores of the Northern Hemisphere. July and August. Root perennial, widely creeping, strong. Stem erect from roundish tufts, reedy, striated at base. Leaves broad, long,

rigid, concave, base auricled, point rolled and spiny, ribs prominent, uniform and flat, glaucous above. Sheaths long, loose, furrowed, smooth; ligule small, short, truncate, toothed. Spike erect, close, glaucous; rachis not winged. Spikelets in pairs, florets three or four, uppermost male, placed in alternate notches. Glumes nearly equal, narrow, lanceolate, downy, stiff, pointed, ribs three; outer and inner glume on the same side of the spikelet. Outer palea mucronate, shorter than glumes, broad, velvety, ribs five; inner palea bifid, with two green marginal ribs. Anthers with a deeper notch at the base than at the apex. Grain adherent.

Elymus arenarius.
Spikelet. For Floret see p. 61.

This well-known sand-binder of solitary growth is fairly common on our shores, where it is used for the same purposes as the Marram. Its rigid stems and leaves hold the sand as it blows, and thus are buried in it for some little depth, and the interlacing fibres of its extensive roots rapidly convert a shifting dune into a barrier that defies the further advance of the sea. In Holland it is carefully cultivated, though once it establishes itself it is hardy enough and fairly prolific. Sinclair called it "the sugar-cane of Britain," owing to the saccharine matter it produces, which amounts to more than a third of its weight, mainly in its stems.

FESTUCA. Plates xxii. and xxiii. *FESTUCEÆ.*

69. *ovina* 15 in. SHEEP'S FESCUE. Inner glume three-ribbed; awns absent or shorter than glumes; leaves awl-shaped.

70. *elatior* 60 in. MEADOW FESCUE. Inner glume three-ribbed; awns absent or shorter than glumes; leaves flat, sheath smooth.

71. *sylvatica* 42 in. REED FESCUE. Inner glume ribless; awns absent or shorter than glumes; leaves flat; sheath rough.

72. *myurus* 15 in. RAT'S-TAIL FESCUE. Inner glume with one rib; awn at least as long as glume.

73. *uniglumis* 12 in. SINGLE-GLUMED FESCUE. Inner glume absent or rudimentary.

69. *F. ovina.* Dry pastures and hilly fields; ranging round the Northern Hemisphere and also found in Australasia. June and July. Root perennial, creeping or tufted, reaching ten inches or more in depth, fibrous, blackish. Stems densely tufted, wiry, erect, rough above, smooth below. Leaves auricled, chiefly radical, tufted, ascending, subulate, that is awl-shaped, folded in bud, upper leaf rough below, bluish green. Sheath smooth, thickened at apex; ligule auricled, concealed in base of blade. Panicle small, narrow, erect, branching on one side. Spikelets upright, small, florets four to six. Glumes shorter than paleæ, slightly unequal, acute, inner with three ribs, outer with one rib. Outer palea small, narrow, rounded on back, pointed, ribs five; inner palea bifid at apex, with green hairy ribs.

Festuca ovina.
Spikelet. For Floret see p. 57.

Varieties—

F. duriuscula Rootstock branching horizontally. Stem two feet high, smooth above; radical leaves awl-shaped, stem leaves flat and channelled; upper leaf smooth below.

F. capillata. Leaves very long; florets awnless.

F. rubra. Stoloniferous; lower sheaths red and hairy.

F. ovaria.	Not tufted.
F. glauca.	Glaucous; leaves rigid, frequently recurved.
F. vivipara.	Leaves growing from glumes

This grass is the favourite food of South Down and Highland sheep, as *Agrostis setacea* is that of the sheep of Dartmoor. With its slender stems, tiny panicles, and short, filiform herbage, it is the best grass for lawns if it can be persuaded to establish itself. It is a pasture grass, useless for hay, the smallest species used in agriculture, thriving on poor, light soils, deep in root, and dying off rapidly when manured. In the mountains of the north it is frequently asexual, becoming viviparous instead. The seed is oblong, flattish, dark golden brown, about three times as long as broad. Hard Fescue (*F. duriuscula*) has a longer seed, not golden brown. It is more frequently sown, owing to its yielding taller herbage; in fact its leaves are sometimes higher than its panicles. The name is derived from the hardness of the panicle when ripe. In dry seasons it becomes creeping. Red Fescue (*F. rubra*) is always creeping, and is an excellent pasture grass on poor dry soils, such as railway embankments.

70. *F. elatior.* Pastures and swampy ground; ranging through Europe and Temperate Asia. July and August. Root perennial, creeping, tufted, reaching twenty inches in depth. Stems numerous, erect, smooth, furrowed; nodes five, blackish. Base of radical leaves round and red, stem leaves auricled, flat, lanceolate, rather broad, ridges prominent, basal margins rough, veins white when held to light, deep green. Sheaths round, smooth; ligule short, not auricled. Panicle variable, leaning to one side; rachis triangular, rough. Spikelets ovate-lanceolate, florets five or more. Glumes unequal, occasionally awned, inner with three ribs, outer keeled. Outer palea long, broad, rough, five-ribbed, awns inconspicuous or absent; inner palea large, acute, edged with a green rib.

Varieties—

F. loliacea.	Panicle spike-like, spikelets almost sessile, alternate, solitary, ligule decurrent; outer palea longer than outer glume.
F. pratensis.	Panicle close, slightly branched; leaves rolled in bud, auricled; sheaths pink below ground, root not creeping.
F. arundinacea.	Panicle spreading; leaves broad.

This is one of the most variable as well as most valuable of grasses, the varieties all changing into one another under different conditions. The true *F. elatior* seems to be *F. arundinacea*, the seed of which is distinguishable by its large size, pointed shape, and roughness on the back, owing to the spines with which the three nerves are armed, which spines are absent in *F. pratensis*. In Germany *F. elatior* is known as *F. pratensis*; and in this country all the varieties except *F. loliacea* seem to be similarly named. Whatever be its name, Meadow Fescue is a valuable agricultural grass on rich and moist lands, yielding a large quantity of hay when cut in flower and good aftermath when grazed. Cattle like its succulent herbage, which is in its prime after the second year. The seed of the most profitable variety is fusiform, rather flat, slightly grooved, and four times as long as broad.

71. *F. sylvatica.* Upland woods and shady, wet places; ranging through Central Europe, rare in Britain. July and August. Root perennial, creeping, tufted, fibrous. Stem slender, smooth, somewhat inclining, leafy, scaly at base. Leaves all flat, reversed at base, broad, long, pointed, ribbed, rough on both sides, margins rough, bright green, upper leaf small. Sheaths close, rough, leafless at base; ligule not auricled, short, blunt, notched or torn. Panicle drooping, unilateral, branches in pairs; rachis angular. Spikelets long and cylindrical, numerous, alternate, inclining to one side, florets three or more. Glumes unequal, very narrow, pointed, ribbed, keeled, the larger awned, both ribless. Outer palea pointed, rough, three ribs, dorsal rib toothed throughout; inner palea with fringed edges.

72. *F. myurus.* Waste places, rocks, tops of walls and other dry situations; ranging through Central and Southern Europe. June and July. Root annual, tufted, fibrous. Stems numerous, erect, slender, smooth; nodes three, smooth. Leaves of a richer dark green than any other grass, narrow, involute, ribs acute and hairy. Sheaths loose, smooth, striated, uppermost reaching panicle; ligule auricled, short and abrupt. Panicle three inches long, slender, feathery, curving or erect; rachis rough, branches short, rough, and angular. Spikelets with five florets, narrow, upright, unilateral, longer than glumes. Glumes very unequal, smooth, keeled, larger three-ribbed and three times the size of the smaller, which has only one rib. Outer palea lanceolate, pointed, as long as the larger glume, with a rough, slender awn as long as itself; inner palea thin, lanceolate, toothed at apex.

Varieties—

F. bromoides.	Panicle long and slender.
F. ambigua.	Panicle close and feathery.
F. sciuroides.	Upper sheath not reaching panicle.

73. *F. uniglumis.* Sandy shores, ranging from the Mediterranean through Western Europe, not found in Scotland. June and July. Root annual, fibrous. Stems several, spreading, geniculate at base, leafy. Leaves linear, narrow, convolute, rigid, hairy above, smooth below. Sheaths loose, smooth, striated, uppermost not reaching panicle; ligule auricled, short, membranous, torn. Panicle unilateral, short, close. Spikelets with four or more florets, crowded, pedicels erect, short, and thickened at apex. Glumes very unequal, the outer the larger, keeled, long awned; inner glume absent or sufficiently minute to justify the specific name. Outer palea short, three-ribbed, awn longer than palea; inner palea shorter than outer, trifid at apex, with two green lateral ribs. In Britain this is a littoral species, but on the Continent it is not confined to the shore.

GASTRIDIUM. Plate x. *AGROSTIDEÆ.*

30. *lendigerum* 18 in. NIT GRASS. Spike pale green and silvery.

Waysides, fields, and woods, ranging through the Mediterranean and Western Europe, but somewhat local. June to October. Root annual, tufted, fibres whitish. Stem erect, smooth, leafy, glossy; nodes three, concealed by sheaths. Leaves flat, acute, rough on ribs and edges, pale green. Sheaths rather tumid, uppermost longer than leaf; ligule oblong, white, torn. Spike fusiform, branches half-whorled in threes or fours, pale green. Spikelets erect, crowded, numerous, one floret. Inner glume the larger, lanceolate, pointed, smooth, tumid at base, shining, keel green and toothed. Outer palea one-third as long as outer glume, jagged at apex, five ribs; inner palea shorter than outer, notched at apex, awned. Anthers purple.

Gastridium lendigerum.
Spikelet. For Floret see p. 46.

HIEROCHLOE. Plate iv. *PHALARIDEÆ.*

9. *borealis* 18 in. NORTHERN HOLY GRASS. Only two stamens in the one perfect floret, but three in each of the two imperfect florets below it.

Scotland, but ranging throughout the north of the Northern Hemisphere. May and June. Root perennial, creeping widely. Stem erect, round and smooth. Leaves tapering at base, lanceolate, flat and netted, rough above. Sheath short and netted; ligule membranous, rounded. Panicle spreading, drooping above, purplish. Spikelets ovate, brown, glossy, terminal floret perfect, others male only. Glumes four, nearly equal, broad,

Hierochloe borealis.
Spikelet. For Floret see p. 64.

pointed, smooth. Outer palea as long as glumes, five-ribbed, hairy, keel rough; inner palea of uppermost floret with one keel, inner palea of lower florets with two keels. Two stamens in uppermost floret, three stamens in the other florets; filaments long.

This sweet-scented grass, though common in Northern Scandinavia, is found in these islands in a wild state only in Scotland, where it is very rare.

HOLCUS. Plate xv. *AVENEÆ.*

45. *lanatus* 24 in. WOOLLY SOFT GRASS. Awn from outer palea curved like a hook.

46. *mollis* 24 in. SOFT GRASS. Awn from outer palea straight and long.

45. *H. lanatus.* Meadows, Europe and Russian Asia. July and August. Root perennial, prominently tufted, not creeping. Stems several, erect, leafy, woolly, with four nodes; nodes without a ring of hairs; shoot with one row of leaves. Leaves rolled in bud, flat, broad, thin, soft, finely ribbed above, keel prominent below, woolly, greyish. Sheaths white with red veins, woolly, tumid, uppermost longer than leaf; ligule short, oblong and hairy. Panicle spreading when in bloom, dense, branches in pairs unequal in length, purplish. Spikelets with two florets, upper male only, lower perfect, pendulous. Glumes unequal, dotted or downy, inner glume the broader and slightly awned. Outer palea shorter than glumes, blunt at apex, hairy at base, glossy; outer palea of upper floret with awn curved like a fish-hook under the outer glume, and rough for a third of its length from the apex; inner palea nearly as long as outer palea, obtuse, edges hairy.

The soft and downy Yorkshire Fog is not so purple and rosy in the shade as it is in the sun, and always has a greyish look. It used to be thought much more of than it is now. It grows tallest in woodland clearings, is productive and easy of cultivation, yields seed in profusion, flowers late, ripens quickly, does best in light flinty soils, is difficult to get rid of, and apt to crowd out more valuable grasses. In New Zealand it is sown for producing herbage earlier than any other species.

Holcus lanatus.
Spikelet. For Floret see p. 48.

46. *H. mollis.* Meadows of Europe and Russian Asia. July and August. Root perennial, deep, creeping widely, not tufted. Stem erect, slender, downy; nodes four, bearded; shoot with two rows of leaves. Leaves flat, linear, flaccid, rather broad, pointed, downy on both sides, dull green. Sheaths white with red veins, nearly smooth, uppermost longer than leaf; ligule short, oblong and hairy. Panicle spreading when in flower, erect, branches in pairs. Spikelets with two florets, upper barren, lower perfect, mostly erect. Glumes unequal, acute, hairy, inner glume the broader and longer, ribs three, outer glume not ribbed. Outer palea half as long as glumes on lower floret, having three hairs at the base, in upper floret having a long stalk with six or more hairs at base and a long straight awn rising from near the apex, rough for more than half its length from its point; inner palea nearly as long as outer palea, blunt, edges fringed.

The Soft Grass has more pointed spikelets and a slenderer habit than the other British representative of the genus. It is the couch grass of light soils, the roots going five feet down, and is very late in reaching maturity. There are eight species of *Holcus* altogether, one of which is native of Cape Colony, the others being mainly European and North African, especially the western part.

HORDEUM. Plate xvii. *HORDEÆ.*

Outer floret perfect; middle floret barren.

52. *sylvaticum* 36 in. WOOD BARLEY. Spikes and leaves of similar green.

Outer floret barren; middle floret perfect.

53. *pratense* 24 in. MEADOW BARLEY. Bright green; outer glumes of all spikelets rough; inner palea lanceolate.

54. *murinum* 12 in. WALL BARLEY. Dull green; outer glumes of middle spikelet ciliated.

55. *maritimum* 9 in. SQUIRREL-TAIL. Glaucous; outer glumes of all spikelets rough; inner palea semi-ovate.

52. *H. sylvaticum.* A woodland species, thriving in shade, ranging throughout Europe, but not found in Scotland. July and August. Root perennial, fibrous, loosely tufted. Stems erect from a curved base, striated, smooth or nearly so; nodes rather hairy. Leaves lanceolate, many ribbed, flat, rough, pointed, auricled at base, slightly notched. Sheaths ribbed, clothed with long deflexed hairs; ligule short and slightly notched. Spike erect, fusiform, dense, green; rachis furrowed and angular, notched alternately. Spikelets clustered in threes in each notch, middle one with one floret generally barren, outer one with one perfect and occasionally one imperfect floret. Glumes of perfect florets awl-shaped, not ciliated, equal, broad, long, three-ribbed, fringed and awned. Outer palea shorter than glumes, five-ribbed, hairy at base, ending in a straight awn, twice as long as palea, rising from below the terminal notch; inner palea two-ribbed, with a bristle at its base.

53. *H. pratense.* Moist pastures in the Northern Hemisphere, but in Britain not further north than Berwick. Root perennial, small, fibrous, occasionally bulbous in barren ground. Stem slightly ascending at base, occasionally decumbent, then

erect, slender, smooth. Leaves auricled, few, linear, flat, acute, toothed at edge, bright green. Sheaths long, close, striated, hairs deflexed; ligule small, short, truncate. Spike parallel sided, long, compressed; rachis notched alternately. Spikelets clustered in threes in each notch, middle one with one floret fertile and sessile, outer ones each with one floret imperfect and stalked. Glumes equal, bristle-shaped, rough, awned. Outer palea of fertile floret lanceolate with awn of similar length; inner palea of fertile floret small and acute, with a bristle at its base.

Unlike Wood Barley, which is of neither use nor ornament, Meadow Barley has good nutritive powers, though it is too rough to be appreciated except by sheep. For hay it is useless, owing to the awns. There are few pastures in which it is not present. It grows well on chalky soil, and is very hardy. It thrives under irrigation, is best when in flower, and loses in value as the seed ripens.

54. *H. murinum.* Building plots, waysides, old gravel pits, and such dry places throughout Europe and Western Asia. June and July. Root annual, fibres branched. Stems numerous, tufted, decumbent at first, then ascending, frequently bent at nodes. Leaves few, narrow, thin, pointed, rough, toothed, lax, wavy, auricled at base, uppermost the smallest. Sheaths loose, tumid, striated, bristly or downy, half embracing base of spike; ligule short, truncate, torn. Spike cylindrical, dense, rather long; rachis notched and winged. Spikelets in threes, clustered in each notch, middle spikelet with one floret fertile, outer spikelet with one floret male only. Glumes of middle spikelet equal, linear-lanceolate, ciliated, ribbed, awned, glumes of lateral spikelets unequal, rough and setaceous. Outer palea lanceolate, rather broad, concave, five-ribbed, awn longer

Hordeum murinum.
Spikelet. For Floret see p. 60.

than palea; inner palea smaller than outer, ovate-lanceolate with two green ribs, edges inflexed, bristle at base.

Variety—

H. arenarium 18 in. Base of stem buried and rooting.

This is really the Mouse Barley (from its hairy spikelets), the *murinum* coming from *mus* and not from *murus*. It is of little agricultural value, but is more nutritive in seed than in flower, unlike all other annual grasses. Its long awns make it dangerous for horses, hence it is useless for hay, and as a matter of fact it avoids pasture and thrives on building plots, not on the walls but where the walls are coming.

55. *H. maritimum*. Seaside of the East and South of England, and ranging from the Mediterranean into Western Europe. June to August. Root annual, a tuft of whitish, flattened, wrinkled fibres. Stems numerous, decumbent, geniculate, widely spreading, terminal portion erect; nodes smooth. Leaves auricled, narrow, short, downy above, hairy below, tapering from base, strongly ribbed on upper surface, glaucous. Sheaths ribbed, smooth, uppermost inflated and longer than leaf; ligule short and truncate. Spike ovoid, rather broad, short, dense, uniform; rachis notched. Spikelets clustered in threes in the notches, middle spikelet with one floret perfect, outer spikelet with one floret imperfect. Glumes bristle shaped, rough, awned, not ciliated. Outer palea smooth, lanceolate, five-ribbed, awned; inner palea semi-ovate, with two central green ribs, inflexed and partly embracing the ovary.

KOELERIA. Plate xxxiii. *FESTUCEÆ*.

99. *cristata* 15 in. CRESTED KOELERIA. Spike silvery, with a break near the base.

Upland and coastal pastures; ranging through Central and Southern Europe. June and July. Root perennial, creeping, slightly tufted, fibres long and downy. Stems numerous, geniculate, ascending, slender, downy above; nodes near base only. Radical leaves tufted, stiff, narrow, tapering; stem leaves tapering at base, broad, stout, pointed, two or three only, uppermost

half-way up the stem, ribs prominent and unequal. Sheaths downy, tumid; ligule short, blunt, jagged. Spike erect, compact, interrupted near base, sub-cylindrical, silvery grey. Spikelets compressed, florets two or three, awnless. Glumes compressed, inner the larger, pointed, lanceolate, ribs three. Outer palea like inner glume, white, glossy, ribs three, keel toothed; inner palea thin, bifid, edges folded and serrated, white.

Koeleria cristata.
Spikelet. For Floret see p. 53.

LAGURUS. Plate viii. *AGROSTIDEÆ.*

23. *ovatus* 12 in. HARE'S-TAIL. Spike short, ovate and silky.

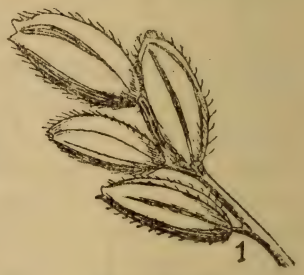
Lagurus ovatus.
Spikelet. For Floret see p. 47.

Sandy shores; Guernsey, ranging from the Mediterranean through Western Europe. June and July. Root annual, fibres woolly and short. Stem geniculate at first, then erect, downy; nodes four or five. Leaves broad, lanceolate, short, many-ribbed, downy on both sides, edges wavy. Sheaths long, tumid and downy; ligule oblong, downy, embracing stem. Spike ovate, less than an inch in length, with long, silky hairs. Spikelets numerous, crowded, one floret. Glumes equal, narrow, long, spreading, plumose. Outer palea shorter than glumes, apex with two awns, back with one long, bent awn; inner palea smaller than outer, with two awns from its apex. Scales lanceolate, obtuse, tumid at base.

LEERSIA. Plate 1. *ORYZEÆ.*

1. *oryzoides* 24 in. CUT GRASS. Glumes absent; panicle spreading.

Ditches and streams south of the Thames. Ranging throughout the Northern Hemisphere. August to October. Root perennial, creeping, runners long and white. Stems tufted, erect, smooth; nodes downy. Leaves linear-lanceolate, flat, striated, thin, edges and keel bristly, glaucous. Sheaths rough, uppermost nearly enclosing panicle; ligule short, blunt, slightly toothed. Panicle loosely branched, wavy; rachis rough and striated. Spikelets numerous, unilateral, flat, with one floret, pale green. Glumes absent. Outer palea shorter than inner, concave, keeled, striped; inner palea linear, keel hairy. Stamens short; anthers long.



Leersia oryzoides.
Spikelet. For Floret see p. 61.

The panicle is wrapped in the upper sheath until the pale green florets open. Its glaucous colour makes it noticeable among the rice fields, and its bristly leaves have given it its Italian name of Asperella. It differs mainly from *Oryza* (rice) in its aborted glumes which are traceable by minute rudiments. There are five species of the genus, three of which are American; one, found only in the tropics of both hemispheres, *L. hexandra*, has six stamens. The British representative was first discovered in Sussex and Hampshire, but is now growing in other southern counties, always in slow running streams, pools, and wet places.

LEPTURUS. Plate xvi. *HORDEÆ.*

49. *incurvatus* 12 in. HARD GRASS. Spikelets alternate; stem geniculate.

Muddy shores and salt marshes of the Mediterranean and Western Europe. July to September. Root annual, a tuft of

fibres. Stem erect or ascending, much branched, bent at nodes, tumid, smooth, slender. Leaves flat, narrow, linear, acute, edges rather involute and prickly. Sheaths long and close; ligule short, obtuse, jagged. Spike erect or curved, long and narrow; rachis notched. Spikelets placed in the notches, alternate, awnless, florets one or two. Glumes nearly equal, occasionally joined at base, flat, lanceolate, thick, pointed, ribs four, edges white and membranous. Outer palea shorter than glumes, narrow, thin, with a green midrib; inner palea smaller than outer and ribless. Anthers white, with a yellow tinge.

Lepturus incurvatus.
Spikelet. For Floret see p. 59.

LOLIUM. Plate xviii. *HORDEÆ.*

58. *perenne* 15 in. RYE GRASS. Stem smooth above; sheath flat and smooth; rachis rough; florets lanceolate.

59. *temulentum* 15 in. DARNEL. Stem rough above; sheath round and rough; rachis smooth; florets tumid.

58. *L. perenne.* Pastures and fields, thriving on clay soils throughout Europe and Asia north of the Himalaya. June and July. Root perennial, tufted, sometimes with leafy barren shoots, fibres reaching fourteen inches in depth. Stems several, smooth, bent at base, erect or ascending, oval, rigid, leafy; nodes tumid and purplish. Base of radical leaves flat and red underground, leaves folded in bud, auricled, flat, narrow, parallel-sided more than half-way, striated, dark green glossy beneath, keel prominent, ribs on upper surface distinct and rounded. Sheaths smooth,

striated, uppermost longer than leaf; ligule short and blunt. Spike flat, nearly erect, notched alternately. Spikelets erect, edgeways on the notches, with three or more florets. Rachilla compressed. Outer glume not longer than spikelet, lanceolate, ribs five, inner glume only to uppermost floret. Outer palea five-ribbed, obtuse, glabrous, rounded on back, occasionally with a short awn; inner palea rather shorter, ciliate.

Lolium perenne.
Spikelet. For Floret see p. 59.

Varieties—

L. aristatum.	Outer palea with a long awn
L. linicola.	Without barren shoots.
L. italicum.	Stem rough; leaves rolled in bud, edges of young leaves involute, leaves auricled, broad, margin smooth; sheaths pink underground; outer palea long awned

This grass was cultivated in this country previous to 1677, the seed being first sown on the Chilterns. It is common almost everywhere, growing on almost all soils, but best where the ground is tenacious. The moister the land the longer it will last provided the water be not stagnant. It is excellent for horses, and its straw cut into chaff furnishes good food for cattle. It soon matures and improves as it ripens, but yields a poor aftermath. Its seed—fusiform, yellowish brown, four-and-a-half times as long as it is broad—is rather large, there being only 6,163,740 to the bushel, which weighs 21 pounds; but the yield is abundant and germination easy. It has numerous varieties—in 1823 Mr. Whitworth, of Acre House, had a collection of sixty of them—the best being *L. italicum*, the grass from which Parmesan cheese is derived, which was introduced from Italy by Mr. Lawson, of

Edinburgh, and is frequently considered to be a distinct species. It also matures quickly, gives plenty of herbage, is eaten greedily by cattle, lasts in full vigour for two seasons, has been known on rich land to yield three crops in a year, and is very profitable under irrigation, in short a more profitable grass than our native species.

59. *L. temulentum*. Pastures and fields of Europe and Central Asia. June and July. Root annual, fibres few, barren shoots none. Stem round, smooth and glossy below, rough upwards; nodes four. Leaves lanceolate, spreading, prominently ribbed, rough above, light green. Sheaths round, ribbed, rather rough; ligule short and notched. Spike large, erect; rachis rough, angular, notched. Spikelets erect edgeways in the notches, florets four or more. Outer glume rising above the spikelet; inner glume rudimentary or absent. Outer palea ovate, tumid, ribbed, whitish, erect, awn as long or longer than palea; inner palea rough at the folds.

Darnel cannot stand frost. It is always found in cultivated fields but not in those in which the seed is sown by drills. Hence it is becoming rarer, and probably was never native but sown with the seed of the crop. It is said to be our only poisonous grass, the seed and not the herbage doing the damage. Like that of *L. remotum* the grain contains loliin, a narcotic soluble in ether, causing eruptions, trembling and sight trouble in man and certain animals, particularly rabbits, but not affecting pigs and horned cattle, nor ducks nor probably other birds if experiments could be made on them

MELICA. Plate xxxii. *FESTUCEÆ*.

96. *nutans*	24 in.	MOUNTAIN MELIC. Spikelets drooping; florets three or four, two perfect, one or two imperfect.
97. *uniflora*	30 in.	WOOD MELIC. Spikelets erect; florets two, one perfect, one imperfect.

96. *M. nutans*. Upland woods of Scotland and west of England; ranging through Europe and Temperate Asia. May

and June. Root perennial, creeping, fibrous. Stem slender, angled, leafy below, bare above. Leaves tapering at base, lanceolate, erect, narrow, flat, edges rough, hairy above, ridged and smooth below, pale green. Sheaths quadrangular, long, smooth, not split in front, uppermost shorter than leaf; ligule very short and blunt. Panicle curving, racemose, unilateral, branches erect, rough, slender. Spikelets large, pendulous, perfect florets two, pedicle short, barren florets one or two, pedicel long. Lodicules single, large. Glumes nearly equal, thin, blunt, purplish. Outer palea chartaceous, elliptic, convex, keeled, broad, blunt, with seven ribs, awnless; inner palea broad, blunt, thick, margined with green.

Variety—

M. montana. Outer palea longer than glumes.

This attractive, bright-coloured species is more a plant of the borders of the woods and clearings than of the woods themselves. It has an unmistakable seed, boat-shaped, twice as long as broad, wrinkled, dark brown and glossy. The lodicule is of importance, the usual pair being represented by one large scale, entire or slightly emarginate. Lodicules are usually considered to be the members of a rudimentary perianth, of which the other member (the posterior lodicule) is present in the *Bambuseæ*, but according to Hackel they represent the halves of a leaf which sometimes, as in this case of *Melica*, remains undivided and can be regarded as a second inner palea as the posterior lodicule would be the third

Melica uniflora.

Spikelet. For Floret see p. 54.

97. *M. uniflora.* Shady woods; ranging through Central and Southern Europe. May to July. Root perennial, creeping, fibrous. Stem erect, slender, smooth, roughish above. Leaves long, flat, thin, tapering at base, ribs and edges rough, ridged below, dark green. Sheaths quad-

rangular, not split in front, uppermost shorter than leaf; ligule short, blunt, with one awl-shaped lobe opposite the blade. Panicle curving, branches in pairs, few, rough, slender. Spikelets erect, ovate, tremulous, with one perfect floret and one barren floret. Glumes unequal, inner the larger, smooth, reddish brown. Outer palea as long as inner glume, broad, blunt, smooth; inner palea shorter than outer, broad, oval, edged with green.

MIBORA. Plate viii. *AGROSTIDEÆ*.

22. *verna* 4 in. KNAPPIA. Panicle short, slender and racemose.

Sandy fields near the sea; Channel Islands and Anglesey, ranging through Southern and Western Europe. March and April. Root annual, small, fibres long and slender. Stems numerous, erect, slender, smooth, triangular, with one or two leaves. Leaves flat, linear, short, obtuse, channelled and rough. Sheaths thin, smooth, compressed, uppermost longer than leaf; ligule membranous, obtuse, notched, clasping stem. Spikes erect, simple, slender. Spikelets erect, alternate, sessile, one floret; rachis slender, smooth, angular, but not notched. Glumes equal, erect, smooth, obtuse, green and purple. Outer palea shorter than glumes, thin, jagged, and hairy; inner palea small and hairy or absent. Filament twice as long as outer palea. Anthers broader at base than at apex.

Mibora verna.
Spikelet. For Floret see p. 45.

This very small and early annual which is generally withered up before Midsummer, averages about a couple of inches in height, and with its trifling foliage and slender thread-like stems, is so inconspicuous that it may not be as rare as it is reputed to be. It is better known as Knappia than by the older name it now bears which was given it by Beauvois.

MILIUM. Plate i. *AGROSTIDEÆ.*

2. *effusum* 60 in. SPREADING MILLET. Awnless; branches of panicle long and distant.

Shady woods, ranging throughout the Northern Hemisphere. June and July. Root perennial, rootstock creeping, stoloniferous and tufted. Stem erect, slender, leafy, tall, smooth and glossy. Leaves linear-lanceolate, tapered and reversed at base, so that the upper side is really the under side, short, ribless, keel prominent, pale green. Sheaths small, striated, uppermost longer than its leaf; ligule square. Panicle large, light, loose and spreading, branches long, slender, horizontal or deflexed. Spikelets numerous, ovate, small, with only one floret. Glumes nearly equal, broad, concave, not keeled, three-ribbed and dotted. Outer palea almost as large as outer glume, pointed, shining, indurated, adherent to grain; inner palea almost as long as outer palea and similarly indurated.

Milium effusum.
Spikelet. For Floret see p. 43.

Variety—

M. scabrum 36 in. Stem and leaves rough.

The curious reversal of the leaf at its base is shown by the stomata being present only upon the original upper side. It is one of the tallest and handsomest of our woodland grasses. In the shade the florets are green, in the sunshine they are purple; in the shade it grows tall, in the open it is stunted. Its produce is very light in proportion to its bulk, and not very nutritious. Birds are so fond of its seed that its cultivation has been suggested where game is preserved to save the cornfields, the seed being scattered round the roots of bushes and raked in with a few decayed leaves thrown over it. It is not the cultivated millet which is *Panicum miliaceum*, quite a different plant.

MOLINIA. Plate xxxi. *FESTUCEÆ.*

95. *cærulea* 36 in. FLYING BENT. Stem solid.

A moorland species growing more or less in the water around pools and springs; ranging through Europe and Temperate Asia. August and September. Root perennial, fibres long, tough, wiry and yellowish. Stem solid, stiff, smooth, bent at the only node, bare above, old blades light and stripped off by the wind. Leaves chiefly radical, tapering at base and sharply pointed, long, rough towards the apex. Sheaths bluish, uppermost smaller than its leaf; ligule a tuft of hairs. Panicle narrow, erect, branches alternate, angular, numerous, rough. Spikelets numerous, erect, small, linear, florets two or three. Glumes unequal, inner the longer, smooth, lanceolate. Outer palea larger than glumes, acute, smooth, awnless, ribs three or five; inner palea flat, membranous, ribs two with a bristle at the base in the uppermost floret. Anthers large, purple. Seed fusiform, brownish or bluish, twice as long as broad.

Molinia cærulea.
Spikelet. For Floret see p. 53.

Variety—

M. depauperata. Spikelets with one floret; outer palea with five ribs.

NARDUS. Plate xvi. *HORDEÆ.*

50. *stricta* 10 in. MAT GRASS. Spike unilateral and slender.

Moors and mountain pastures of Europe and Asia up to the Arctic Circle; by the margins of bogs, but never in the bogs, as it requires a dry soil. June to August. Root perennial, tufted, stringy, fan-shaped and deep, fibres many, short, thick, and

downy. Stems many, in wiry tufts, erect, rather angular, striated. Leaves like bristles, sharp, straight, furrowed, rough with lines of spines, base thick and cartilaginous, mostly horizontal. Sheaths pinkish, enlarged, bulbous at base, each outer sheath enclosing two or more leaves, of which the inner is erect; ligule on radical leaves truncate, on stem leaves pointed, thick, stiff, and prominent. Spike slender, straight or curving backwards. Spikelets with one floret, alternate, unilateral, placed in grooves, only one glume, and that very narrow and pointed. Outer palea linear-lanceolate, purplish, ribbed, rough, tapering into an awn; inner palea thin, short, narrow, embraced by outer palea, ribless, apex truncate and toothed. Anthers pale yellow.

Nardus stricta.
Spikelet.
For Ovary and Stigma see p. 58.

PANICUM. Plates ii. and iii. *PANICEÆ.*

Spike digitate.

3. ***sanguinale*** 24 in. FINGER GRASS. Leaves and sheaths hairy.

4. ***glabrum*** 8 in. GLABROUS FINGER GRASS. Leaves and sheaths glabrous

Spike simple.

5. ***verticillatum*** 24 in. ROUGH BRISTLE GRASS. Involucral bristle depressed.

6. ***glaucum*** 24 in. GLAUCOUS BRISTLE GRASS. Involucral bristles erect; outer palea with transverse wrinkles.

7. ***viride*** 24 in. GREEN BRISTLE GRASS. Involucral bristles erect; outer palea unwrinkled.

Spike compound.

8. ***crus-galli*** 36 in. COCKSPUR. Spikelets purple on one side.

3. *P. sanguinale*. Fields, south of England, but a native of the Tropics and warm regions. June to August. Root annual, fibrous, Stem creeping at base, then ascending, slender, branched, ribbed. Leaves flat and hairy. Sheaths hairy; ligule large, rounded and hairy at base. Panicle digitate, spikes from three to seven, long, spreading. Spikelets in pairs, one sessile, one stalked, unilateral, dorsally compressed, purple, with one floret. Glumes three in number, unequal, one very small, third double as large as second, all awnless. Outer palea as large as third glume, smooth, margins folded, awnless, purple; inner palea small, but in other respects resembling outer palea.

The Finger Grass (3) is cultivated in Bohemia, where the grain is used for porridge; and in the southern United States, under the name of Crab Grass, it is thought much of as a fodder plant. In this country it flourishes in rich, light soil, but is hard and coarse, and its hairy herbage is of no use, though birds pick out the seeds while ripening among the florets. It spreads a good deal, owing to the lower stems striking root.

4. *P. glabrum*. Sandy fields south of England, but a native of warm regions. July and August. Root annual, fibrous. Stems numerous, creeping at first, then ascending, smooth, leafy, striated. Leaves short, broad, glabrous, margins hairy. Sheaths glabrous; ligule blunt, and frequently hairy at base. Panicle digitate, spikes two or three, not exceeding three inches in length, slender. Spikelets in twos and threes, stalked, flat at back, one floret, purple. Glumes three in number, one small, two nearly equal, five-ribbed. Outer palea as large as largest glume, ribbed, glossy; inner palea ribbed, glossy. Awns none.

5. *P. verticillatum*. Fields south and east of England, ranging throughout Europe and Asia. July and August. Root annual, fibrous. Stem geniculate, branched at base, smooth above, rough below. Leaves lanceolate, pointed, edges rough. Sheaths smooth, striated; ligule blunt, short, fringed. Spike whorled, rough. Spikelets small, sessile, flattened at back, bristly, bristles depressed, one floret. Glumes three in number, one small,

broad and pointed. Outer palea large, concave, smooth, three-ribbed; inner palea flat and folded. Awns none.

The depressed bristles account for the roughness of the spike when drawn downwards through the hand.

6. *P. glaucum.* Fields; a native of warm countries, probably introduced. June to September. Root annual, fibrous. Stem erect, furrowed, angled beneath spike. Leaves linear-lanceolate, bearded at base, glaucous. Sheaths shorter than leaves; ligule small. Spike compact, cylindrical. Spikelets dorsally compressed, crowded, florets two, bristly, bristles erect. Glumes three in number, the third the largest. Outer palea wrinkled transversely; inner palea smaller than outer. Awns none.

The erect bristles account for the roughness of the spike when drawn upwards through the hand.

7. *P. viride.* Fields, a native of warm climates. July and August. Root annual, fibrous. Stems numerous, geniculate, smooth below, frequently rough above. Leaves lanceolate, rough. Sheaths smooth, ribbed; ligule short, blunt, margin hairy. Spike compact, branches hairy. Spikelets dorsally compressed, crowded, bristly, bristles erect, green, one floret. Glumes three in number, one small, the other two equal. Outer palea as large as the larger glume, smooth, not wrinkled transversely; inner palea flat and folded at edges. Awns none.

Panicum viride.

Spikelet. For Floret see p. 62.

The Green ristle Grass is found chiefly in East Anglia; it is not common, though, perhaps, more frequent than the two preceding species. Its nutritive value being slight it does not exhaust the soil, and thrives in the same places on dry, sandy ground for years without manure.

8. *P. crus-galli*. Fields; south of England, a native of warm climates. July and August. Roots annual, fibrous. Stems numerous, decumbent, then erect, stout, smooth, furrowed; nodes bare. Leaves broad, pointed, rough, midrib prominent. Sheath swollen; ligule represented by hairs or a white mark. Spike compound, dense, unilateral, branches tapering. Spikelets clustered, ovate, dorsally compressed, purple on one side, hairs long and smooth, one floret. Glumes three, one small, the others equal, the second being hairy and the third awned. Outer palea transparent, smooth, glossy, awnless; inner palea small and glossy. Stamens long.

Cockspur is readily distinguishable by the tufted bristles among the spikelets. In some parts it is cultivated for fodder, though with us it is a coarse grass, best known as a weed in corn-fields. It is the tallest British representative of the genus, but quite a dwarf compared with *Panicum altissimum*, which in the West Indies reaches thirty feet in height.

PHALARIS. Plate iv. *PHALARIDEÆ*.

11. *canariensis* 36 in. CANARY GRASS. Spike ovoid; spikelets imbricated.

Fields and waste places, ranging through Southern Europe and Northern Africa. June to August. Root annual, fibres white and numerous. Stem erect, round, leafy, brown at nodes. Leaves broad, acute, spreading, glaucous. Sheaths long, round, tumid, rough, uppermost forming a spathe; ligule long and blunt. Spike ovoid, variegated green and white. Spikelets with one floret, broad and flat, imbricated. Glumes four, lower pair nearly equal, winged, flat, keeled, and pointed. Paleæ hard and glossy. Outer palea shorter than glumes, ovate, pointed,

Phalaris canariensis.
Spikelet. For Floret see p. 62.

hairy; inner palea shorter than outer, toothed at apex, hairy.

This ornamental grass is said to be a native of the Canary Isles, owing its introduction to its being used as a bird-seed, for which purpose it is grown in the south-eastern counties, where it is reaped like wheat and bound into sheaves. In Germany weaver's paste is made from its flour. It is particularly distinguished as an impoverisher of the soil, the yield being less than half in each succeeding year when no fertilisers are used.

PHLEUM. Plates v. and vi. *AGROSTIDEÆ*.

Spike long and cylindrical.

13. *pratense* 36 in. TIMOTHY. Glumes truncate; ligule thin, white, and toothed at apex.

15. *boehmeri* 24 in. PURPLE STALKED CAT'S-TAIL. Glumes tapering; ligule broader than long.

16. *asperum* 12 in. ROUGH CAT'S-TAIL. Glumes wedge-shaped; ligule tapering and prominent.

Spike short and fusiform.

14. *alpinum* 24 in. ALPINE CAT'S-TAIL. Glumes truncate; ligule short and obtuse.

17. *arenarium* 12 in. SEASIDE CAT'S-TAIL. Glumes acute; ligule lanceolate.

13. *P. pratense*. Pastures; Northern Hemisphere. June and July. Root perennial, fibrous, somewhat creeping, reaching sixteen inches in depth, rootstock short. Stem erect, smooth, round; base of shoots bulbous. Leaves rather broad, rigid, acute, ribs low, blade rough downwards from point, rough upwards from base, rising at an angle, not spreading horizontally, rolled in bud, light green or glaucous. Sheaths nearly smooth, not tumid, fibrous; ligule thin, longer than broad, white, toothed at point, hairless on back. Spike rough, cylindrical, green, compact, and long. Spikelets with one floret, flat and crowded. Glumes equal, silvery, keeled, broad, truncate, fringed on the keel, each with a short rough awn of less than half the length of the glume. Outer

palea smaller than glumes, ovate, five-ribbed, pointed, awnless; inner palea shorter than outer, with two nerves, pointed, fringed. Styles and stamens protruding; anthers flesh colour and rather long.

Timothy is one of our native grasses, but owes its name to Timothy Hanson, by whom it was first cultivated largely in the United States, and thence introduced at his recommendation into British pastures. In America it attains six feet in height, here the conditions are not so favourable to it, and it is shorter, harder, and coarser, not a favourite with cattle, though making excellent heavy hay. Its first crop is good, but its aftermath is poor. Moist tenacious soils suit it best; in dry soils it becomes bulbous. It is at its best in its second year, and when cut soon after flowering. Sinclair found that the seed weighed 43 pounds to the bushel, and calculated that each bushel contained 35 million seeds. The seeds are naked, ovoid, twice as long as broad, lightly pitted, and yellowish brown in colour. They seldom fail to germinate, but the crop requires a good deal of nitrogenous manure to keep it up to the mark in this country.

Phleum pratense.
Spikelet. For Floret see p. 44.

Variety—

P. nodosum 24 in. Decumbent, leaves narrow, spike slender.

14. *P. alpinum.* Mountains, chiefly Scottish, ranging throughout the Northern Hemisphere and also found in Southern Chile. July and August. Root perennial, rather tuberous and creeping. Stem ascending, simple, smooth, round. Leaves flat, acute, smooth, ribs equal, edges rough. Sheaths smooth, tumid, striated, uppermost long; ligule short and obtuse. Spike

compact, not exceeding an inch in length, generally purple. Spikelets oblong, small, spreading. Outer glume truncate, keel continued into an awn. Outer palea ovate, keel hairy, awned; inner palea shorter than outer, fringed at edge. Anthers short and broad.

15. *P. boehmeri.* Pastures, east of England, ranging through Europe and Northern Asia. July and August. Root perennial, fibrous, tufted. Stem purple in colour, glossy, leafy below, bare above, occasionally bulbous. Leaves linear, short, ribs rough; upper leaves very short; glaucous. Upper sheaths long, slightly tumid; ligule shorter than broad, truncate. Spike compact, slender, cylindrical, about two inches long. Spikelets flat, curved, small, crowded. Glumes equal, tapering, fringed with bristles and pointed or slightly awned. Outer palea small, membranous, elliptical, ribbed; inner palea smaller than outer, and having a small bristle at the base. Anthers long and purple.

This is rather a rare species, growing in dry, sandy places and chalky districts in the eastern counties. It is recognisable by the violet colour of the upper part of the stem. It affords but a feeble yield of herbage, and at flowering time consists almost entirely of stems. It was first noted in 1780 near Swaffham. Sinclair pointed out that its inflorescence looks like a spike until pressed between the fingers, when it proves to be a panicle.

16. *P. asperum.* Waste places, East of England; ranging through Central and Southern Europe. July and August, Root perennial, fibres much branched. Stem smooth, branched. leafy. Leaves flat, acute, ribbed, rough, bright green. Sheaths slightly tumid, uppermost long; ligule tapering and prominent. Spike compact, cylindrical, noticeably rough. Spikelets flat, numerous, not glaucous. Glumes equal, wedge-shaped, slightly rough, ribbed, mucronate, green and white. Outer palea short, elliptical, obtuse, not crenate; inner palea shorter than outer palea, edges folded. Anthers short; filaments long.

17. *P. arenarium.* Sandy shores of Western Europe. June and July. Root annual, fibres long, simple and downy. Stem

erect, leafy below, bare and purplish above. Leaves short, broad, rough, blade folded. Sheaths long, ribbed, smooth, uppermost very long and tumid; ligule lanceolate. Spike compact, blunt at apex, tapered at base, green and white. Spikelets oval, numerous, glaucous, with one floret, like the rest of the genus. Glumes equal, acute, lanceolate, rough, fringed on keel, awn very short or absent. Outer palea broad and short, crenate, ribbed and membranous; inner palea as long as outer, smooth and ribbed. Anthers short, filaments long,

POA. Plates xxvi. to xxx. *FESTUCEÆ.*

Stems and sheaths bulbous.

93. *bulbosa* 15 in. BULBOUS MEADOW GRASS. Uppermost leaf shorter than sheath.

Stems and sheaths not bulbous.
Florets webbed.

88. *pratensis* 24 in. SMOOTH-STALKED MEADOW GRASS. Ligule short and rounded, broader than long; stem rounded.

89. *trivialis* 24 in. ROUGH-STALKED MEADOW GRASS. Ligule long and pointed.

87. *compressa* 12 in. FLATTENED MEADOW GRASS. Ligule prominent, short and blunt; stem oval.

90. *nemoralis* 36 in. WOOD MEADOW GRASS. Ligule minute or absent.

Florets not webbed.
Florets hairy at base.

81. *maritima* 12 in. SEA MEADOW GRASS. Outer palea five-ribbed; uppermost node below middle of stem; small glume reaching base of second floret; rachis smooth.

82. *distans* 24 in. Reflexed Meadow Grass. Outer palea five-ribbed, uppermost node below middle of stem; small glume reaching base of second floret; rachis rough.

86. *annua* 10 in. Annual Meadow Grass. Outer palea five-ribbed; uppermost node below middle of stem; small glume reaching base of third floret.

91. *laxa* 12 in. Wavy Meadow Grass. Outer palea three-ribbed; panicle drooping; uppermost leaf lanceolate and flat.

92. *alpina* 15 in. Alpine Meadow Grass. Outer palea three-ribbed; panicle erect; uppermost leaf linear and folded.

Florets not hairy at base

79. *aquatica* 72 in. Reed Meadow Grass. Glumes without lateral ribs; central rib of outer palea rough throughout; panicle compound; spikelets less than half an inch long.

80. *fluitans* 42 in. Manna Croup. Glumes without lateral ribs; central rib of outer palea rough throughout; panicle simple; spikelets more than half an inch long

84. *rigida* 6 in. Hard Meadow Grass. Glumes without lateral ribs; basal half of outer palea smooth; apex of inner glume reaching base of third floret.

85. *loliacea* 6 in. Darnel Meadow Grass. Glumes without lateral ribs; basal half of outer palea smooth; apex of inner glume reaching base of fourth floret.

83. *procumbens* 12 in. PROCUMBENT MEADOW GRASS. Glume with prominent lateral ribs.

79. *P. aquatica.* Ponds and ditches, ranging throughout the Northern Hemisphere. April to August. Root perennial, fibres whorled, rootstock extensively creeping. Stem erect, compressed, stout, striated, reed-like. Leaves flat, broad, stiff, smooth, rough at edges and on keel, shoot flat, base of blade with a brown triangular spot on each side, leaf and sheath with large air cavities. Sheath with two acute edges, almost entire, nearly smooth ; ligule short and blunt. Panicle erect, pyramidal, large, spreading, repeatedly compound, half-whorled ; branches rough, angular. Spikelets erect, ovate, upper broader than lower, florets four to ten. Glumes nearly equal, thin, glossy, whitish. Outer palea blunt, with five or seven ribs, central rib rough ; inner palea shorter than outer palea, toothed at apex, punctate.

This stately, reed-like, pale green grass, though seemingly so rigid, is really very tender, a favourite with cattle and the best of fodder for milch cows. In the fen districts and on small islands and river meadows on the Thames and elsewhere it is mown for hay. It does best on undrained clay soils, and its long, dark brown seeds have to be sown in the mud.

80. *P. fluitans.* Ponds and slow-running water ; ranging throughout the Northern Hemisphere. July and August. Root perennial, creeping or partly floating. Stem weak, decumbent, stoutish, often floating, then ascending ; nodes numerous. Leaves prominently ridged, long, linear, keeled, shoot flat, base of blade with yellow triangular spot on each side, pale green. Sheath keeled, long, compressed, striated, almost entire, nearly smooth ; ligule short, pointed, toothed. Panicle simple, nearly erect, long, close, narrow, rough, rather one-sided. Spikelets few, long, slender, florets seven to twenty, variegated green and white. Glumes unequal, small, blunt, with a green keel. Outer palea with five ribs, middle one rough and pointed, three times longer than broad ; inner palea small, flat, inflexed at edges, which are ribbed with green, not punctate. Anthers five times as long as broad, purple, yellow when empty.

Varieties—

P. plicata.	Sheath rough and furrowed ; outer palea twice as long as broad ; anthers three times as long as broad.
P. pedicellata.	Sheath rough and furrowed ; anthers four times as long as broad.
P. declinata.	Sheath smooth ; anthers twice as long as broad ; plant small

This grass is common in slow streams and pools, and is noticeable for its graceful panicles and rich green colour. Its stem is very fragile, and it is not easy to pull at it without breaking it. Cattle feed on the herbage, and birds and trout on the seeds. The long, slender, yellow seeds are the manna croup which is put into soup and cooked for porridge

81. *maritima.* Salt marshes ; ranging through the Northern Hemisphere. June to August. Root perennial, tufted, creeping, stoloniferous. Stem erect from a curved or geniculate base, rigid, smooth. Leaves thickish, narrow, short, involute, compressed, not keeled. Sheaths tumid, smooth, uppermost longer than leaf ; ligule short, ovate blunt. Panicle erect or nearly so, rigid, branched ; branches and rachis smooth. Spikelets few, linear, cylindrical, turning to one side, florets four or more. Glumes unequal, rounded on back, ribbed, inner one the larger, Outer palea five-ribbed, long, pointed, edges involute, purplish ; inner palea as long as outer palea, marginal ribs green. Anthers six times as long as broad.

Varieties—

P. hispida	Stem compressed, rachis furrowed on one side, branches bristly.
P. deflexa.	Panicle branches deflexed in fruit.

82. *P. distans.* Banks of estuaries and waste and sandy ground ; ranging throughout the Northern Hemisphere. July to October. Root perennial, fibrous, yellowish, not creeping.

Stems numerous, decumbent, and geniculate at base, often slanting, scaly, striated, leafy. Leaves tapering, broad, short, flat, ribs low, rough above, seldom folded, hooded at apex, glaucous. Sheaths long, smooth, spiral, deeply slit, uppermost longer than leaf; ligule short, blunt, notched. Panicle erect, spreading, angular; branches long, distant, lower deflexed; branches rough, rachis rough, compressed on one side. Spikelets linear, small, flattened, not webbed, florets three or more. Glumes unequal, obtuse, inner, the larger, with three ribs, outer with one rib. Outer palea longer than glumes, blunt, with five ribs, the central rib not extending to apex, deeply concave, edges not involute inner palea small.

83. *P. procumbens*. Salt marshes and sandy places near the sea; ranging through the Northern Hemisphere. July and August. Root annual, fibrous. Stems tufted, numerous, procumbent, rigid, smooth, leafy. Leaves flat, ribbed, rough above, smooth beneath. Sheaths long, smooth, tumid, ribbed, uppermost longer than leaf; ligule pointed, long, torn. Panicle compact, rigid, small, branches rough, in pairs turning one way, not deflexed, rachis rough, three-sided. Spikelets in two rows, linear, florets four or more. Glumes unequal, small, inner with three ribs, outer with one rib. Outer palea hairy at base, with five ribs, middle rib extending beyond apex; inner palea narrow fringed

Variety—

P. borreri. Leaves involute, rough on both sides, short, flat, abruptly hooded at apex; sheaths long; keel of outer palea sharply pointed.

84. *P. rigida*. Quarries, tops of walls, and other dry places in limestone districts throughout Central and Southern Europe. June and July. Root annual, fibrous, tufted, woolly. Stems several, tough, wiry, slender, decumbent at first, then erect; nodes three or four. Leaves narrow, short, involute, tapering,

rough above, smooth below, turning brown with age. Sheaths ribbed, smooth ; ligule long, acutely triangular. Panicle lanceolate, dense, two-ranked, turning one way, branches rigid and wavy, rachis angular. Spikelets compressed, cylindrical, florets seven to ten. Glumes unequal, acute, keeled, apex of inner glume level with base of third floret. Outer palea broad, pointed, with two marginal green ribs having a white median stripe ; inner palea short and bordered with green.

85. *P. loliacea*. Sandy shores of the Mediterranean, and Western Europe. June and July. Root annual, tufted, fibrous. Stem curved, ascending, branching from base, rigid, stout. Leaves linear, pointed, thin, flat, short, convolute when dry, turning reddish brown with age. Sheaths long, smooth, uppermost as long as leaf ; ligule oblong. Panicle racemose, close, erect, slender. Spikelets oblong, usually solitary, in two alternate rows, unilateral, stalks short and thick, florets six or more. Glumes nearly equal, pointed, keeled, ribless, inner glume extending to base of fourth floret. Outer palea keeled, blunt with a small point, ribs five ; inner palea with keel fringed and well defined marginal ribs.

86. *P. annua*. Widely distributed in both Hemispheres, mostly in waste places, and flowering at any time of the year. Root annual, fibres numerous. Stems several, tufted, spreading, decumbent, or ascending, rooting from nodes. Leaves folded in bud, thin, tapering from near apex, rounded at apex, flaccid, transversely wrinkled, rough at edges, ribless, median lines yellow. Sheath long, smooth, compressed, edges rounded, uppermost longer than leaf ; ligule conspicuous, long, rounded at apex. Panicle triangular, loose, erect, more or less one-sided, branches thin. Spikelets ovate, not webbed, stalked, glossy, florets five or more, variegated green and white. Glumes unequal, three-ribbed, middle rib toothed, inner glume extending to base of third floret. Outer palea five-ribbed, smooth ; inner palea short, with green marginal rib. Anthers colourless.

Varieties—

P. supina.	Panicle lax, branches deflexed, spikelets green and purple.
P. sericea.	Leaves not wrinkled.

This species is the first weed to appear on the newly gravelled path, and is responsible for most of the bare patches in lawns during the winter. It will produce flowers and seeds when only an inch high, coming up and blooming and ripening all within a month. It blooms all the year round, even in December and January. When growing in watery places its leaves lose their wrinkles, and it is then known as *P. sericea.*

87. *P. compressa.* Fields and dry places in the Northern Hemisphere. June and July. Root perennial, moderately creeping, fibres downy. Stem oval, decumbent or slanting, then erect, smooth, constricted at base of panicle ; nodes four to seven, uppermost half-way up the stem. Leaves folded in bud, short, narrow, roughish at edges, hooded at apex, ribless, with median lines, glaucous, Sheaths compressed, short, uppermost as long as leaf ; ligule short, blunt. Panicle erect, dense when not in flower, unilateral, branches in pairs, rough, acutely angular. Spikelets ovate, small, florets three or more, webbed at base. Glumes nearly equal, with three ribs, of which the middle one is toothed. Outer palea obtuse, slightly longer than glumes, with five ribs, of which the odd ones are hairy and the even ones indistinct ; inner palea short, edged with green.

Variety—

P. polynoda.	Nodes numerous, uppermost more than half-way up the stem.

This species is so much liked by sheep that it never flowers when they are grazing on it. The crop is light, but what there is of it is good.

88. *P. pratensis.* Common in meadows in the Northern Hemisphere. June and July. Root perennial, creeping, stoloniferous, reaching from five to fifteen inches in depth according to

the soil. Stems several, erect, smooth, rather stout, branched at base. Leaves folded in bud, radical leaves short, shoot flat with rounded edges, blade flat, linear, broadish, rounded at base and apex, ribless, with yellow median lines. Sheaths long, slightly tumid, almost entire; ligule short, rounded, broader than long. Panicle loose, pyramidal, spreading, slightly unilateral, branches generally smooth. Spikelets ovate, compressed, florets three or four, glossy, webbed. Glumes nearly equal, lanceolate, webbed, ribs three. Outer palea pale brown, longer than glumes, acute, keeled, ribs four or five, of which three are hairy, webbed; inner palea hyaline, short and bifid.

Poa pratensis.
Spikelet. For Floret see p. 56.

Varieties—

P. planicularis.	Stem flat; leaves broad and short; dark green.
P. arenaria.	Outer palea with seven ribs; glaucous.
P. retroflexa.	Lower branches of panicle deflexed; pale green.
P. sub-cærulea.	Stem round; leaves broad and short.
P. arida.	Uppermost leaf erect and as high as apex panicle.

This is a good, early meadow grass, well adapted for parks and lawns, yielding a fair hay crop and an excellent aftermath. After midsummer it grows more slowly but still steadily, and goes on steadily even during frost, but it rarely sends up flowering stems after the first are cropped. It thrives on dry light soils, and when seeds are mixed for sowing a permanent pasture it generally forms a twentieth (by weight) of the mixture. In New Zealand this species becomes as luxuriantly stoloniferous as couch.

89. *P. trivialis.* Meadows and pastures of the Northern Hemisphere. June and July. Root perennial, not stoloniferous, fibrous, tufted, attaining fourteen inches in depth. Stem rough, erect, slender. Leaves folded in bud, radical leaves long, stem leaves short, flat, thin, rough, tapering from base, ribless, with median lines, keeled and glossy below. Sheaths angular, rough upwards, as long as leaf, uppermost longer than leaf; ligule of lower leaves blunt, of upper leaves long and pointed. Panicle pyramidal, spreading, large, loose, branches rough and slender. Spikelets ovate, compressed, florets two or three, webbed. Glumes nearly equal, lanceolate, ribbed, webbed. Outer palea acute, keeled, ribs five, of which the midrib is hairy below; inner palea short, fringed, edged with green.

This is said to be the Orcheston Grass described as growing at Maddington, in Wiltshire, twenty feet long; its average height is just as many inches. It is a valuable agricultural grass, prevalent in all good pastures with rich, retentive soils, satisfactory to all sorts of cattle, yielding hay of high quality, and, after early cutting, an excellent aftermath. It thrives under trees and in all moist places, and grows rapidly in warm weather, but does not like frost. It yields a fine close turf, and is abundant on most lawns, but is best when mixed with other grasses. It is the commonest grass in the mountainous districts of Europe.

90. *P. nemoralis.* Woods and shady places, ranging through Europe and Russian Asia. July and August. Root perennial, slightly creeping, but not stoloniferous, reaching to fifteen inches in depth. Stem erect, slender, smooth, flattish; uppermost node half-way up stem, black. Leaves folded in bud, thin, tapering, narrow, apex acute, rough above and on edges, ribless with median lines. Sheaths round, smooth, close, uppermost no longer than leaf; ligule very short and blunt or absent. Panicle slender, somewhat diffuse, turning to one side, branches filiform, rough, angular. Spikelets lanceolate, compressed, webbed, florets two or more. Glumes nearly equal, webbed, ribs three. Outer palea larger than glumes, lanceolate, tapering, ribs five, three hairy; inner palea slightly fringed.

Varieties—

P. angustifolia.	Panicle loose, stem slender, uppermost node near to panicle.
P. coarctata.	Panicle close, stem rigid.
P. glaucantha.	Glaucous.
P. parnelli.	Nodes five or six, uppermost below halfway ; ligule very broad and short.
P. balfourii.	Nodes three ; uppermost two-thirds of the way down ; ligule prominent and blunt.
P. glauca.	Uppermost node near base of stem ; glaucous.

A hardy, slender, graceful grass of the woods and shady places, but thriving anywhere when sown. No species does better on land shaded by trees, and none is better for parks and lawns.

91. *P. laxa.* Scottish mountains, an Arctic, or rather Sub-Arctic, species. July and August. Root perennial, fibrous, tufted, slightly creeping. Stem round, slender, smooth ; nodes two, the upper generally hidden. Leaves folded in bud, flat, lanceolate, hooded at apex, roughish above and on edges, ribless with median lines, glaucous. Sheaths round, smooth, almost entire, uppermost longer than leaf ; ligule long and pointed. Panicle drooping, angular, branches few. Spikelets ovate, webbed, florets two or more. Glumes equal, ovate, pointed, webbed. Outer palea with three ribs, hairy below ; inner palea short, edges ribbed with green.

Varieties—

P. stricta.	Leaves flat at apex.
P. flexuosa	Panicle branches wavy, often viviparous.

92. *P. alpina.* Mountains of Scotland and West of Ireland, ranging through similar districts in the Northern Hemisphere. July and August. Root perennial, compactly

tufted, slightly creeping, rootstock thick, fibres smooth. Stem tufted, often swollen at base, leafy below, smooth, striated; nodes two, upper not hidden. Leaves short, folded in bud, linear, mucronate, rough above and on edges, ribless, with median lines; radical leaves tufted. Sheaths long, smooth, lax, almost entire, uppermost longer than leaf; ligule of upper leaves long and pointed. Panicle ovate, short, spreading when in flower, branches angular, smooth, mostly in pairs. Spikelets broad, glossy, florets three or more. Glumes equal, ovate, concave, ribs three, not webbed. Outer palea pointed, ribs three, hairy below, lateral ribs indistinct; inner palea short, edges green and fringed.

This is the broad-leaved hill grass of the Highland shepherds. Its produce is equal to Meadow Foxtail and more nutritive. In the Scottish mountains, where it is frequently viviparous, the pastures of it were in many cases formed by transplantation or by sowing seed after burning the heather, the seed being tramped in by sheep driven over the ground. As the spikelets are a favourite food of snails, the seed is not easy to obtain, and hence the laborious operation of bringing the young plants from a distance.

93. *P. bulbosa.* Among the sands of East and South of England, ranging through Europe and Russian Asia. April and May. Root perennial, somewhat creeping, bulbous, the bulbs being enlarged leaf bases. Stem erect, slender, smooth, often geniculate at base, purplish. Radical leaves numerous, tufted, narrow, wavy, pointed; stem leaves folded in bud, few, distant, linear, small, thin, ribless with median lines. Sheaths tumid, ribbed, smooth, uppermost below middle of stem and longer than its leaf; ligule long, decurrent, pointed. Panicle small, compact, spreading in flower, branches alternate, mostly in pairs, tumid, and cartilaginous at base; rachis angular and wavy. Spikelets ovate, compressed, webbed, florets three or four. Glumes equal, pointed, concave, with three ribs, keeled, webbed. Outer palea longer than glumes, erect, straight, with five indistinct ribs, keel clothed with white hairs; inner palea shorter than outer palea, white margined with green and fringed.

Variety—

P. minor. Leaves folded and incurved, tapering at tip; upper ligule long, lower ligules short.

This is one of the most interesting plants of the seaside. The young bulbs are blown about the sands for weeks until the autumn rains come, when they settle themselves in a spot that is comfortable to them, take deep root, and thrive, so that in the spring they produce a dense tuft of foliage peculiarly grateful to cattle.

POLYPOGON. Plate viii. *AGROSTIDEÆ.*

24. *monspeliensis* 18 in. ANNUAL BEARD GRASS. Awn more than three times as long as spikelet.

25. *littoralis* 24 in. PERENNIAL BEARD GRASS. Awn less than three times as long as spikelet.

24. *P. monspeliensis.* Fields; south-east of England, ranging through Temperate Asia, the Mediterranean, and Western Europe. July and August. Root annual, fibres downy and short. Stems numerous, decumbent at base, then erect, leafy; nodes smooth. Leaves flat, broad, pointed, spreading, flaccid, edges and ribs rough, glaucous. Sheaths long, smooth, striated, uppermost longer than leaf; ligule long, pointed, rough on back. Spike slightly branched, silky, yellowish. Spikelets numerous, crowded, one floret. Glumes nearly equal, linear, notched at apex, hairy, striped with green, keel toothed, awn at least thrice as long as spikelet. Outer palea half as long as glumes, ovate, notched, awned; inner palea shorter than outer, transparent, notched, awnless. Scales oblong.

25. *P. littoralis.* Salt marshes, south-east coast from Norfolk to Hampshire, ranging through the Mediterranean, Western Europe, and North America. July and August. Root perennial, rootstock creeping, tufted, branched. Stem decum-

bent at first, rooting at lower nodes, then erect, slightly branched, smooth; nodes smooth. Leaves flat, narrow, short, stiff, rough, glaucous. Sheaths smooth, striated, uppermost longer than leaf; ligule downy, long, acute, prominent. Spike well branched, glossy, purplish. Spikelets flat, small, numerous, one floret. Glumes equal, narrow, linear-lanceolate, hairy, keel toothed, with long awn from near the apex. Outer palea shorter than glumes, notched at apex with long awn in the notch; inner palea shorter than outer, notched at apex, thin, awnless.

Polypogon littoralis.
Spikelet. For Floret see p. 45.

PSAMMA. Plate x. *AGROSTIDEÆ.*

31. *arenaria* 36 in. MARRAM. Spike pale yellow, about five inches in length.

Sandhills on the coast, ranging throughout Europe and North America. July and August. Root perennial, creeping deeply and extensively, rootstock yellow, smooth, fistulose, with white, woolly fibres from joints. Stem erect, smooth, hard, bare at top and often horizontal in the ground. Leaves reversed at base, long, rigid, narrow, concave, prominently furrowed above, ridges alternate, smooth below, glaucous. Sheaths long, striated, convolute; ligule long, lanceolate, deeply cleft. Spike fusiform, straw-coloured. Spikelets lanceolate, acute, crowded, with one floret. Glumes nearly equal, the outer the larger, obtuse, narrow, rigid, outer with one rib, inner with three ribs. Outer palea, linear-lanceolate, with four or five ribs, rigid, notched, pointed, keel bristly, hairy at base; inner palea

Psamma arenaria.
Spikelet. For Floret see p. 47.

slightly smaller than outer, narrow, edges fringed, base with a bristle. Anthers changing from purple to pink.

Variety—

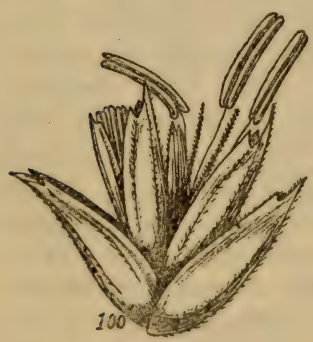
P. baltica Spike large and interrupted; glumes lanceolate and acuminate.

The Marram is as often known as *Ammophila arenaria*, but whether *Ammophila* or *Psamma*, it is the only representative of its genus, unless *P. baltica* be given specific rank. Known and protected for centuries as a sand-binder, its long, pale brown seed is still sown. The way in which its thick network of rhizomes spreads among loose blown sand and forms it into ridges dense enough to withstand the washing of the waves, can only be realised by those who have seen it. Like a few other grasses, its leaf-blades undergo a complete reversal at their base, so that the under side becomes the upper side, shown by the stomata being on the original upper side as in *Milium*.

SESLERIA. Plate xxxiii. *FESTUCEÆ*.

100. *cærulea* 18 in. BLUE MOOR GRASS. Spike imbricated, bluish.

Limestone districts of Northern Britain and the north and west of Ireland; ranging throughout Europe. May and June. Root perennial, densely tufted, fibres long, strong, and deep. Stem simple, smooth, slender, bare, leafy at base, nodes near base, light green. Leaves linear, firm, spreading or curving, single-ribbed, keeled, keel and edges rough, radical leaves narrow, stem leaves broader, smooth below, rough above, mucronate. Sheaths short, almost entire, compressed, covering the nodes; ligule small or absent. Spike ovoid, erect, about half an inch in length, glossy, bluish. Spikelets clustered, imbricated, florets



Sesleria cærulea.
Spikelet. For Floret see p. 51.

two or three, lower florets with a bract at base. Glumes nearly equal, keeled, membranous. Outer palea rather larger than glumes, toothed at apex, ribs five, awned or pointed ; inner palea narrow, cleft, margins involute and fringed. Anthers tipped with purple. Seed obovate, greyish yellow.

This is the most nutritious of the grasses of the moors. It is more like a rush than a grass, and common enough in hill pastures and other suitable places, often thriving amid bleak surroundings, though a sharp, early frost will prevent its flowering for the year.

SPARTINA. Plate xvi. *HORDEÆ.*

48. *stricta* 24 in. CORD GRASS. Twin spikes.

Salt marshes in estuaries of the south and east coasts of England, and the coast of the North Atlantic. June to September. Root perennial, creeping by jointed suckers, tough, white fibres extending deeply from the crown. Stems erect from a curved base, stout, soft, sheathed almost throughout. Leaves rigid, erect, flat, glabrous, white at edges, upper surface channelled. Sheaths ribbed, smooth, jointed to leaves, uppermost the longest ; ligule a row of bristles. Spikes in pairs, linear, erect, rigid. Spikelets with one floret, numerous, alternate, inserted in grooves along two sides of a triangular stem. Outer glume the smaller, awl-shaped, placed in the thick stalk bearing the inner glume. Outer palea obtuse, entire, hairy, dorsal rib spiny ; inner palea larger than outer, glabrous, with two inconspicuous median ribs.

Spartina stricta.
Spikelet. For Floret see p. 50.

Varieties—

S. townsendii Rachis extending beyond spike, leaves jointed to sheaths.

S. alterniflora Rachis extending beyond spike, leaves continuous with sheaths, uppermost leaf higher than spike ; spikes four or more.

TRIODIA. Plate xxxii. *FESTUCEÆ.*

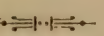
98. *decumbens* 12 in. HEATH GRASS. Glumes rosy.

Heaths and mountain pastures, ranging through Europe and Western Asia. July and August. Root perennial, creeping, tufted, fibres numerous. Stem decumbent, then ascending, rather flat, smooth, and leafy. Leaves narrow, flat at base, channelled at outer end, pointed, rough edged, keeled, ribless with median lines, glaucous above, dark green below. Sheaths with white throat hairs, grooved, uppermost sheath shorter than leaf; ligule a tuft of hairs. Panicle contracted, branches rough. Spikelets large, erect, oval, few, florets two to five, generally four, awnless. Glumes nearly equal, enclosing florets, long, ovate, pointed, ribs three, keel straight and pointed. Outer palea concave, ovate, ribs five, hairy at base, apex with three teeth, of which the middle one is generally conspicuous; inner palea flat, membranous, edges involute and thickened at base.

Triodia decumbens.
Spikelet. For Floret see p. 52.

CHAPTER VIII.

TABULAR VIEW OF BRITISH GRASSES.



IN this table the order is the same as in the second chapter. For the reason already given the arrangement is that of Bentham and Hooker (1904), from whom the following analysis is necessarily adopted in the main, but it has been altered and amplified to make it useful as a further help to identification.

PANICACEÆ.

Articulation of spikelets with pedicels occurring beneath the glumes. Spikelet with one perfect floret placed above the male or barren florets (if any) or the glumes

PANICEÆ. Outer palea stouter than the glume beneath. *Panicum*, 3-8.

ANDROPOGONEÆ. Outer palea thinner than the glume beneath, and often bearing a twisted awn. *Polypogon*, 24, 25.

POACEÆ.

Articulation of spikelets with pedicels (when present) occurring beneath the outer palea but above the glumes. Spikelets with one or more florets, and frequently a male floret or glume above them, the male floret occasionally below them.

PHALARIDEÆ. Glumes normally four, two below the articulation, two above it (usually small and empty or with a male floret in each), the lower glumes occasionally deficient.

PHALARIDEÆ—*Continued.*

Florets solitary, glumes absent, panicle loose. *Leersia*, 1.

Florets solitary, inner palea absent, spike dense. *Alopecurus*, 18-21.

Florets solitary, outer glumes winged, spike dense. *Phalaris*, 11.

Florets solitary, outer glumes not winged, panicle loose. *Digraphis*, 12.

Florets in threes. Stamens only two in number. *Anthoxanthum*, 10.

Florets in threes, uppermost of each group perfect, the other two male only. *Hierochloe*, 9.

STREPTATHERÆ. Spikelets with one, two, or (rarely) more perfect florets. Outer palea with usually a bent or twisted (often dorsal) awn; inner palea two-nerved, generally thin or small.

AGROSTIDEÆ. Spikelet with one floret, paleæ usually very thin.

Inflorescence an alternate spike. *Mibora*, 22.

Inflorescence a panicle; glumes narrow; a small hairy tuft at base of florets. *Agrostis*, 26-29.

Inflorescence a panicle; glumes large and shining. *Gastridium*, 30.

Inflorescence an ovoid spike with long, silky hairs. *Lagurus*, 23.

Inflorescence a panicle; florets very hairy. *Calamagrostis*, 32-35.

Inflorescence a cylindrical spike. *Psamma*, 31.

AVENEÆ. Spikelet with two or more florets (rarely with four), paleæ well developed and firm.

Inflorescence a spike. *Phleum*, 13-17.

Inflorescence a panicle. Florets in twos. Upper floret male only. Plant woolly. *Holcus*, 45-46.

Inflorescence a panicle. Florets in twos. Awn of outer palea short. *Aira*, 36-40.

STREPTATHERÆ.—*Continued.*

Inflorescence a panicle. Florets in twos or more. Awn on outer palea long and twisted. *Avena*, 41-43.

Inflorescence a panicle. Lower florets male only. *Arrhenatherum*, 44.

ASTREPTÆ. Spikelets with several (rarely one or two) perfect florets. Outer palea awnless or ending in a straight awn; inner palea prominently two-nerved or two-keeled, usually as long or nearly as long as the glumes.

MILIEÆ. Spikelets paniculate, with one or two florets, the rachilla not produced beyond the floret. *Milium*, 2.

CHLORIDEÆ. Spikelets with one or more florets, sessile along the simple branches of the panicle.

Spikes digitate, branches three, four, or five. *Cynodon*, 47.

Spikes branched; branches two or (rarely) three. *Spartina*, 48.

HORDEÆ. Spikelets with one or several florets, and usually sessile in the notches of a simple spike

Florets solitary; spikelets on alternate sides of spike; axis jointed at each notch. *Lepturus*, 49.

Florets solitary; spikelets alternate in two rows on unilateral spike, only one style. *Nardus*, 50.

Florets in twos or fours; two spikelets in each notch. *Elymus*, 51.

Florets in threes; three spikelets in each notch. *Hordeum*, 52-55.

Florets many; one spikelet in each notch; edge of glumes adjoining axis. *Agropyrum*, 56, 57.

Florets many, one spikelet in each notch; back of glumes adjoining axis. *Lolium*, 58, 59.

Florets many; axis of spike not notched. *Brachypodium*, 60, 61.

FESTUCEÆ. Spikelets with several florets, and stalked.

Inflorescence a panicle, loose or compact; florets many; style placed on one side of apex of ovary; outer palea terminating above base of awn. *Bromus*, 62-68.

ASTREPTÆ—*Continued.*

Inflorescence a panicle or spike; florets many; style terminal; outer palea ending in the awn, lateral veins, convergent and not continuing throughout; leaf sheaths divided to base. *Festuca*, 69-73.

Inflorescence a panicle; spikelets in dense, unilateral clusters; outer paleæ compressed, veins five, keel fringed. *Dactylis*, 74.

Inflorescence a spike, unilateral; pectinate bract at base of spikelet. *Cynosurus*, 75, 76.

Inflorescence a loose panicle; spikelets flat and orbicular. *Briza*, 77, 78.

Inflorescence a panicle, spreading or compact; style terminal; outer palea awnless, glumes unequal. *Poa*, 79-93.

Inflorescence a panicle, half-whorled and spreading; glumes broad and truncate or jagged; florets as a rule in twos. *Catabrosa*, 94.

Inflorescence a loose panicle; axis of spikelet ending in a bristle. *Molinia*, 95.

Inflorescence a slender panicle, unilateral or nearly so; florets in ones or twos, with a club-shaped rudiment. *Melica*, 96, 97.

Inflorescence a contracted panicle; spikelets awnless and large; florets in twos or threes; glumes pointed and long, and enclosing the florets; outer palea bifid or trifid. *Triodia*, 98.

Inflorescence a spike, cylindrical, or obtuse; stigmas protruding from base of floret; spikelets without a basal bract. *Koeleria*, 99.

Inflorescence a spike, cylindrical, or ovoid; stigmas protruding from apex of floret; spikelets with a basal bract. *Sesleria*, 100.

Inflorescence a large, diffuse panicle; florets enveloped in the long, silky hairs of the axis; style long. *Arundo*, 101.

No.	Name.	Height in inches.	Panicle.	Spike.	Florets.	Glumes.	Paleæ.	Awned.	Awnless.	Notes.
	Leersia.									
1	oryzoides ..	24	*		1	0	2		*	Nodes downy.
	Milium.									
2	effusum	60	*		1	2	2		*	Leaves reversed at base.
	Panicum.									
3	sanguinale ..	24		*	1	3	2		*	Leaves and sheaths hairy.
4	glabrum	8		*	1	3	2		*	Leaves and sheaths glabrous.
5	verticillatum ..	24		*	1	3	2		*	Leaf-edges rough; sheath smooth.
6	glaucum ..	24		*	2	3	2		*	Leaves glaucous, bearded at base.
7	viride	24		*	1	3	2		*	Leaves rough; sheaths smooth.
8	crus-galli ..	36		*	1	3	2	*	*	Leaves broad; sheath tumid.
	Hierochloe.									
9	borealis	18	*		3	4	2		*	Leaves rough above; sheath netted.
	Anthoxanthum.									
10	odoratum ..	18		*	3	4	2		*	Odour hay-like.
	Phalaris.									
11	canariensis ..	36		*	1	4	2		*	Leaves broad and glaucous; ligule long and blunt.
	Digraphis.									
12	arundinacea ..	48	*		1	4	2		*	Keel of leaves prominent; sheaths tumid; ligule short.

No.	Name.	Height in inches.	Panicle.	Spike.	Florets.	Glumes.	Paleæ.	Awned.	Awnless.	Notes.
	Phleum.									
13	pratense	36		*	1	2	2	*		Sheaths fibrous.
14	alpinum	24		*	1	2	2	*		Leaf-edges rough; sheath tumid.
15	boehmeri . .	24		*	1	2	2	*	*	Leaves short; ligule short.
16	asperum	12		*	1	2	2		*	Leaves light green; ligule tapering and prominent.
17	arenarium . .	12		*	1	2	2	*	*	Leaves short; sheath long and ribbed.
	Alopecurus.									
18	agrestis	24		*	1	2	1	*		Leaves rough above; sheaths rough and tumid.
19	pratensis	24		*	1	2	1	*		Leaves dark green; sheaths blackish.
20	geniculatus . .	12		*	1	2	1	*		Stem bent at nodes.
21	alpinus	18		*	1	2	1	*	*	Stem bent at lowest node only.
	Mibora.									
22	verna	4		*	1	2	2		*	Plant diminutive; leaves channelled.
	Lagurus.									
23	ovatus	12		*	1	2	2	*		Leaves broad and short; ribs numerous; sheaths long and tumid.
	Polypogon.									
24	monspeliensis . .	18		*	1	2	2	*		Leaves broad and glaucous; ribs and edges rough.
25	littoralis	24		*	1	2	2	*		Leaves narrow, glaucous, rough.

No.	Name.	Height in inches.	Panicle.	Spike.	Florets.	Glumes.	Paleæ.	Awned.	Awnless.	Notes.
	Agrostis.									
26	alba	24	*		1	2	2		*	Leaves rather broad, rolled or flat.
27	canina	12	*		1	2	1 or 2	*		Radical leaves bristle-shaped; stem leaves narrow and toothed.
28	setacea	24	*		1	2	2	*		Radical leaves bristle-shaped; stem leaves narrow and rough.
29	spica-venti ..	36	*		1	2	2	*		Nodes near base; leaves rough beneath.
	Gastridium.									
30	lendigerum ..	18		*	1	2	2	*		Sheaths hiding the three nodes.
	Psamma.									
31	arenaria	36		*	1	2	2		*	Ligule long and bifid.
	Calamagrostis.									
32	epigeios	48	*		1	2	2	*		Stem rough just beneath panicle.
33	lanceolata ..	48	*		1	2	2	*		Nodes wide apart; leaves light green below.
34	stricta	36	*		1	2	2	*		Leaves two or three only.
35	strigosa	24	*		1	2	2	*		Stem short and slender.
	Aira.									
36	cæspitosa ..	42	*		2	2	2	*		Leaves ridged and rough downwards.
37	flexuosa	12	*		2	2	2	*		Sheaths rough near tips.

No.	Name.	Height in inches.	Panicle.	Spike.	Florets.	Glumes.	Paleæ.	Awned.	Awnless.	Notes.
	Aira—cont.									
38	canescens ..	10	*		2	2	2	*		Leaves glaucous, with grey hairs.
39	præcox	6	*		2	2	2	*		Stem leaves pale green; sheaths angular and tumid.
40	caryophyllea ..	12	*		2	2	2	*		Stem leaves pale green; sheath angular and striated.
	Avena.									
41	fatua	36	*		2 or more	2	2	*		Stem smooth and glossy.
42	pratensis ..	18	*		3—6	2	2	*		Stem roughish.
43	flavescens ..	24	*		3 or 4	2	2	*		Stem smooth; nodes downy.
	Arrhenatherum.									
44	avenaceum ..	42	*		2	2	2	*		Leaves and sheaths keeled.
	Holcus.									
45	lanatus	24	*		2	2	2	*		Sheath red-veined; leaves greyish.
46	mollis	24	*		2	2	2	*		Sheath red-veined; leaves dark green.
	Cynodon.									
47	dactylon ..	8		*	1	2	2		*	Sheaths covering all the nodes.
	Spartina.									
48	stricta	24		*	1	2	2		*	Odour offensive; leaves white at edges.
	Lepturus.									
49	incurvatus ..	12		*	1 or 2	2	2		*	Stem smooth, tumid, curved at nodes.

No.	Name.	Height in inches.	Panicle.	Spike.	Florets.	Glumes.	Palea.	Awned.	Awnless.	Notes.
	Nardus.									
50	stricta	10		*	1	1	2	*		Leaves horizontal, rough, with rows of spines.
	Elymus.									
51	arenarius ..	48		*	2—4	2	2		*	Leaves ridged, with long-pointed ears at base.
	Hordeum.									
52	sylvaticum ..	36		*	1 or 2	2	2	*		Leaves broad, thin and firm; sheath hairy,
53	pratense	24		*	1	2	2	*		Leaves narrow, bright green; sheath narrow and hairy.
54	murinum ..	12		*	1	2	2	*		Leaves narrow, dull green; sheath tumid and downy.
55	maritimum ..	9		*	1	2	2	*		Leaves short and glaucous.
	Agropyrum.									
56	repens	36		*	3 or more	2	2	*	*	Leaves spreading horizontally in one direction.
57	caninum	24		*	5 or less	2	2	*		Leaves almost upright.
	Lolium.									
58	perenne	15		*	3 or more	1 or 2	2		*	Stem oval; leaves glossy beneath.
59	temulentum ..	15		*	4 or more	1 or 2	2	*		Stem round; leaves light green.

No.	Name.	Height in inches.	Panicle.	Spike.	Florets.	Glumes	Paleæ.	Awned.	Awnless.	Notes.
	Brachypodium.									
60	sylvaticum ..	24		*	8 or more	2	2	*		Leaves drooping, and reversed at base.
61	pinnatum ..	24		*	7 or more	2	2	*		Leaves erect; midrib prominent.
	Bromus.									
62	erectus	30	*		4 or more	2	2	*		Stem erect; nodes downy.
63	asper	72	*		4 or more	2	2	*		Leaves and sheath with white keel.
64	sterilis	30	*		6 or more	2	2	*		Stem erect from a curved base; sheath angular.
65	maximus ..	30	*		8	2	2	*		Stem erect from a curved base; sheath round and downy.
66	madritensis ..	12	*		8	2	2	*		Stem erect, kneed; ligule short and broad.
67	arvensis	15	*		7 or more	2	2	*		Stem erect; nodes covered by sheaths.
68	giganteus ..	48	*		3 or more	2	2	*		Stem erect; nodes purple; leaves constricted in middle.
	Festuca.									
69	ovina	15	*		4—6	2	2	*	*	Leaves awl-shaped; base of leaf not auricled; ligule with upright ears.
70	elatior	60	*		5 or more	2	2	*	*	Nodes blackish.

No.	Name.	Height in inches.	Panicle.	Spike.	Florets.	Glumes.	Palæ.	Awned.	Awnless.	Notes.
	Festuca—cont.									
71	sylvatica.. ..	42	*		3 or more	2	2	*		Leaves rough, reversed at base, bright green.
72	myurus	15	*		5	2	2	*		Nodes three; leaves ridged, full dark green.
73	uniglumis ..	12	*		4 or more	2	2	*		Stems several; sheaths loose.
	Dactylis.									
74	glomerata ..	36	*		3—5	2	2	*		Leaves thick, broad and flat; shoots flat; sheaths flat.
	Cynosurus.									
75	cristatus ..	24		*	many	2	2	*		Sheath yellow.
76	echinatus ..	10		*	2—5	2	2	*		Nodes small, internodes short; leaves ovate at base.
	Briza.									
77	media	15	*		6—8	2	2		*	Stem glossy; leaves erect.
78	minor	12	*		5 or more	2	2		*	Nodes five; leaves erect and broad.
	Poa.									
79	aquatica	72	*		4—10	2	2		*	Brown triangle at leaf-base.
80	fluitans	42	*		7—20	2	2		*	Yellow triangle at leaf-base.
81	maritima ..	12	*		4 or more	2	2		*	Leaf edges curving upwards from midrib.
82	distans	24	*		3 or more	2	2		*	Stem slanting; leaves broad and glaucous.

No.	Name.	Height in inches.	Panicle.	Spike.	Florets.	Glumes.	Paleæ.	Awned.	Awnless.	Notes.
	Poa—cont.									
83	procumbens ..	12	*		4 or more	2	2		*	Stem procumbent and rigid.
84	rigida	6	*		7—10	2	2		*	Stem wiry; nodes three or four.
85	loliacea	6	*		6 or more	2	2		*	Stem curved.
86	annua	10	*		5 or more	2	2		*	Leaves angular at base; ligule long.
87	compressa ..	12	*		3 or more	2	2		*	Stem oval.
88	pratensis	24	*		3—4	2	2		*	Stem smooth, branched at base; leaves rounded at ends.
89	trivialis	24	*		2 or 3	2	2		*	Stem rough; leaves tapering from base.
90	nemoralis ..	36	*		2 or more	2	2		*	Black node in middle of stem.
91	laxa	12	*		2 or more	2	2		*	Nodes two; upper node hidden.
92	alpina	15	*		3 or more	2	2		*	Nodes two; upper node not hidden.
93	bulbosa	15	*		3 or 4	2	2		*	Stem bulbous at base.
	Catabrosa.									
94	aquatica	36	*		2 or more	2	2		*	Leaves blunt or bifid, lower leaves floating.
	Molinia.									
95	cærulea	36	*		2 or 3	2	2		*	Bend at node; sheath purplish.

No.	Name.	Height in inches.	Panicle.	Spike.	Florets.	Glumes.	Paleæ.	Awned.	Awnless.	Notes.
	Melica.									
96	nutans	24	*		3 or 4	2	2		*	Stem angular; leaves ridged below.
97	uniflora	30	*		2	2	2		*	Stem quadrangular; ligule with tooth.
	Triodia.									
98	decumbens ..	12	*		2—5	2	2		*	Leaves glaucous above; light green beneath.
	Koeleria.									
99	cristata	15		*	2 or 3	2	2		*	Nodes only near base; stem leaves broad, ridges unequal.
	Sesleria.									
100	cærulea	18		*	2 or 3	2	2	*	*	Leaves bluish.
	Arundo.									
101	phragmites ..	120	*		3 or 6	2	2		*	Leaves keeled at base only.

CHAPTER IX.

THE SEEDS OF THE GRASSES.

In looking over a collection of grass seeds we cannot help remarking that they all seem to belong to one group, unlike those of some other botanical orders in which the seeds of a few of the species are so different from the rest in external appearance as to cast a doubt on the classification. To a large extent this is due, of course, to their being coated with some of their floral envelopes. When these are firm and close-fitting, as in the fescues, they seem to be the natural coatings of the grain, but in some species, as in sweet vernal, the coverings are so ample and chaffy that we can quite understand why it is more profitable to buy such things by weight instead of measure. Whether they be conspicuous or not, it is evident that if the paleæ and glumes remain the same in the fruit as in the flower, the descriptions already given hold good in both cases, and afford the obvious means of distinguishing the seeds.

The identification of the seeds is, however, not without its difficulties ; and perhaps one of the best ways to begin is to get a packet for lawn purposes from a seedsman and sort out the constituents. The clover seeds, which are always present, distinguishable at once by their roundness, can be set aside, and the enquirer will find the rest consisting largely of fescues and poas with a dash of foxtail, and, maybe, one or two others. Mixtures for pastures are made up almost invariably from the five clovers—red and red perennial (*Trifolium pratense* and *T. pratense perenne*), both with stone-coloured seeds, alsike (*T. hybridum*) with greenish seeds, white (*T. repens*) with small mustard-yellow seeds, and suckling (*T. minus*) with smaller brownish-yellow seeds—all their seeds being rounded ; lucerne

(*Medicago sativa*) with large yellowish seeds, and trefoil (*M. lupulina*) with large brownish seeds, oval like those of the other; bird's-foot trefoil (*Lotus corniculatus*) with small, round, dark-brown seeds; sheep's parsley (*Petroselinum sativum*) with large curved, dark grey seeds; and yarrow (*Achillea millefolium*) with narrow, thin, grey transparent seeds; the grasses being a selection from the six fescues—meadow fescue (*Festuca elatior* and *F. pratensis*) and sheep's fescue (*F. ovina*) and its hard, red, and various-leaved varieties (*F. duriuscula, F. rubra*, and *F. rubra heterophylla*)—the two rye grasses (*Lolium perenne* and *L. italicum*), cock's-foot (*Dactylis glomerata*), timothy (*Phleum pratense*), meadow foxtail (*Alopecurus pratensis*), fiorin (*Agrostis alba* var. *stolonifera*), dog's-tail (*Cynosurus cristatus*), the smooth meadow-grass (*Poa pratensis*), the rough meadow-grass (*Poa trivialis*), and vernal grass (*Anthoxanthum odoratum*), together with accidentals which are often, not always in fairness, described as adulterants.

Of these sixteen grasses, vernal, though in small quantities, can be picked out at once. There is no mistaking the rich, deep chestnut of the whole spikelet minus the glumes in which it comes to market, pale tipped and thickly haired, one awn straight the other kneed, the well-hidden grain being smooth, fusiform, and laterally compressed; and the rather more useless German substitute Puel's vernal (*A. puelii*) is as easy of identification, the awns being longer and slenderer and the hairs light brown instead of dark brown. Timothy seed also has a character of its own. The difference between it and vernal is great, one looking like a mass of chaff, the other like a seed, small, ovoid, lightly pitted, twice as long as broad, pointed at base, pale greyish brown in colour, more silvery when scantily wrapped in its palea, as it frequently is, though still retaining its seed-like appearance.

Meadow foxtail, too, has a seed which once seen is never forgotten—whitish-grey husks about a quarter of an inch long, the whole spikelet with the straight awn of the flowering period twisted and bent as maturity was reached, the silvery glumes with the hairy keel by which the spikelets cling to each other,

the small grain, yellow, shining, flat, ovate, frequently with traces of the stigma. The clinging of the spikelets is characteristic, those of the substitute, slender foxtail (*Alopecurus agrestis*), having no hairs on the keel and always falling apart, besides being a trifle larger. Fiorin seed is also easily distinguishable in a mixture. It is one of the smallest of grass seeds, like a small oat a sixteenth of an inch in length and as thin as a hair, grooved, contracted at the base, yellow corn-coloured with whitish tips, the paleæ grey with no awn or basal hairs, but as the grain is readily freed from them they are not always present.

The seeds of the remaining ten of these customary pasture grasses are not so easily described, though some of them are instantly distinguishable. The largest is that of cock's-foot, which is about a quarter of an inch long, the light, faded, straw-coloured paleæ enclosing the grain having a short awn ; they are flattened at the sides, ribbed, bristly on the keel, and curved at the tip ; the fragment of the rachilla is broad and flat and tapers downwards as it rises from the base of the inner palea ; the grain is yellowish white, fusiform, narrowing towards the apex more than towards the base, and it is rounded on one side and flat on the other, whereas the other grains in this group have no flat side, being either concave or convex.

The seed of dog's-tail is of the same type as those of the fescues but differs from them in its colour. It varies in its proportions, being much slenderer in some cases than in others. As a rule it is mustard yellow, that being the colour of the outer palea, which is rounded on the back and ends in a long, rough, curved point, the inner palea being pale brown with dark, shining spots ; the rachilla is smooth, short, and tapers downwards, and the grain is ovate, slightly grooved, flattened, and pointed at both ends.

The grain of the fescues has a very long hilum ; that of the poas has a rounded hilum. In the fescues the grain is almost club-shaped in form, whereas that of the poas is ovate. *Festuca elatior* and *F. pratensis* are apparently forms of the same species ; in both the rachilla has a flat, projecting top, but in *F. ovina* and its varieties the rachilla is obliquely truncate, concave at

the apex, and juts out like a bone. The seeds of *F. elatior* are grey, long, and rather narrow. Those of *F. pratensis* are faded straw colour, smaller, and more elastic. The seeds of the other fescues are much smaller, those of *F. ovina* being only half as long; but to distinguish between them, as known to commerce, is futile, if, according to Percival, they are all derived from the same parcel—as they certainly seem to be—by screening, the smallest without awns being sent out as *F. ovina* (*tenuifolia*), the larger with tapering awns going as *F. duriuscula*, and so on. As a rule those of *F. ovina* are yellowish brown, those of *F. rubra* are greyish brown and stouter in form, with the awn rising sharply, those of *F. duriuscula* are grey and hard looking, and those of *F. heterophylla* greyer and flatter and having a stouter awn.

In the poas the seed is small—about the same size as that of *F. ovina*—and angular in appearance, and the grain is loose within the paleæ and shakes out readily. In *Poa pratensis* the palea is nerved, long, and brownish; the grain is ovate, pointed at both ends, the apex bearing remains of the stigma; it is rounded on the back and concave on the other side, and has no groove, or only a faint indication of one. In *P. trivialis* the palea is smooth with distinct ribs, long, brownish, the grain being ovate, rounded at both ends, and having a well marked groove on the ventral surface. Of the two other species used in farming, *P. compressa* has a nearly glabrous seed with obtuse paleæ, and *P. nemoralis* has a short, pointed seed without nerves or hairs.

Very different seeds are those of the yellow oat, *Avena flavescens*, which are so enveloped in the chaffy paleæ—the long, kneed, twisted awn being conspicuous—that they look and feel like particles of fluff, the stalk being flat and hairy and the grain flat, slender, pointed at both ends, and having no groove on its yellow, shining surface. Another soft seed is that of Yorkshire fog (*Holcus lanatus*), which consists of the whole spikelet, the paleæ enclosing the grain, those of the barren floret, and the glumes, all silvery white, and easily known by the awn, which began straight and curved into a hook as the fruit ripened into the grain, which is ovate, pointed, and hairy at the tip and

grooved on the ventral surface. Yorkshire fog is often found as an adulterant with meadow foxtail and sometimes with rye grass, but is quite as recognisable as yellow oat when used in a similar way with cock's-foot.

The foregoing being all the seeds likely to be met with in sorting out a purchased mixture, we may now briefly deal with those we may come across in the field as helping in however slight a degree in the identification of the plant.

AGROPYRUM.—The seed of *A. repens* is of the same character as that of wheat; boat-shaped, greyish brown, hairy above, rounded on the back, and slightly grooved; the rachilla tapers downwards; the awn of the outer palea when present is short. That of *A. caninum* is similar but has a longer awn.

AGROSTIS.—The seed of *A. canina* differs from that of *A. alba*, already described, in being larger and the palea being punctate and awned; that of *A. spica-venti* has a few silky hairs at the base of the outer palea.

AIRA.—In *A. cæspitosa* the palea is toothed and awned, the rachilla is hairy, and there is a ring of hairs at the base of the seed; the grain is white and shining. In *A. flexuosa* the palea has four teeth at the apex and a dorsal awn near the base, and there are basal hairs; the grain is grooved and dark in colour. The awn in *A. canescens* is bearded in the middle and thick and white above; the grain is yellow, polished, and small. *A. præcox* has a short awn and no basal hairs. *A. caryophyllea* has a thin, dark, twisted awn twice as long as the palea, not bearded or thickened, and the seed is comma-shaped and dark brown.

ALOPECURUS.—The seeds of *A. geniculatus* are similar to those of meadow foxtail, but the glumes are more open and not so pointed.

ARRHENATHERUM.—In *A. avenaceum* the palea has a tuft of hairs at the base, the longer awn is dark brown marked with a pale spiral band; the grain is pale brown, fusiform, and has no groove.

ARUNDO.—The seed of *A. phragmites* is pale purple, long, pointed, and smooth; the rachilla has silky hairs at the base.

AVENA.—In *A. fatua* the palea has yellow hairs, the awn is

brown, the hairs on the rachilla are slender, and the grain is grooved. In *A. pratensis* the rachilla hairs are stout.

BRACHYPODIUM.—The palea of *B. sylvaticum* is straw-coloured, ribbed, and hairy and has a long terminal awn, the rachilla is smooth and stout, and the grain has a shallow groove. The palea of *B. pinnatum* is boat-shaped, the awn is smooth and short, and the grain is slender.

BRIZA.—The seed is ovoid and dark brown in both species; that of *B. media* being the larger.

BROMUS.—In *B. erectus* the palea is flat above and incurved below; the awn is long, narrow, smooth, and stiff; the rachilla is long and thin; and the grain is purplish brown, flat, long, pointed at both ends, with remains of the stigma on the sides near the tip. In *B. asper* the grain is reddish, long and narrow. The palea in *B. sterilis* is reddish brown, with a long, serrulate awn; the grain is narrow and flat, and the rachilla is flat and tapers downwards. In *B. arvensis* and its varieties the palea is oblong with ciliate ribs, the awn is smooth, and the grain is flat and thin. In *B. giganteus* the awn is long and sub-terminal and serrulate, the rachilla is bristly and so is the base, and the grain is thin, flat, and glabrous, but shorter than in *B. erectus*.

CALAMAGROSTIS.—*C. epigeios* has a tuft of long silky hairs at the base of the palea which is bifid at the tip, and the awn is slender and dorsal. In *C. lanceolata* the awn is less than half the length of the palea, which has a tuft of hairs at the base.

CATABROSA.—In *C. aquatica* the palea is not winged or inflated but broad and flat.

DIGRAPHIS.—The grain of *D. arundinacea* is free; it is dark greyish brown, long, flat, finely dotted, and without a groove.

ELYMUS.—The seed of *E. arenarius* is about half an inch long, whitish, and rather narrow, the palea being stiff, pubescent, and pointed; the rachilla is large and hairy.

FESTUCA.—In addition to the species mentioned above it should be said that the grain of *F. myurus* is mammillate upwards and the rachilla small.

HOLCUS.—The seed of *H. mollis* can be distinguished from that of *H. lanatus* by the awn, which is kneed instead of hooked.

HORDEUM.—In *H. sylvaticum* the palea is very rough, the awn is twice as long as the grain, and the grain is narrow and angular. The spikelet of *H. pratense* is reddish, the awn is not double as long as the grain, and the grain is angular and faintly nerved. In *H. murinum* the awn is serrulate.

KOELERIA.—The rachilla of *K. cristata* is noticeably large, and the seed is keeled and awnless and pale whitish yellow.

LEERSIA.—The grain of *L. oryzoides* is brown, of much the same character as rice, grooved and slightly flattened.

LOLIUM.—The rachilla of *L. temulentum* is cylindrical and smooth, and not broad and flat as in *L. perenne*, the palea being ovate and awned.

MELICA.—The seed of *M. nutans* is glossy, dark purplish brown, and, like the grain, is ovate and wrinkled.

MILIUM.—In *M. effusum* the seed is glossy white, slender-pointed at the end, and slightly flattened.

MOLINIA.—The seed of *M. cærulea* resembles a bird in flight with the wings upraised; the palea is keeled, glabrous, and awnless; the rachilla is long, oblique, and projecting; the colour is brownish or purplish.

NARDUS.—The seed of *N. stricta* is triangular and serrulate on the angles; the awn is also toothed, and the grain has no groove.

PANICUM.—The grain of *P. crus-galli* is glossy dark brown, and it is grooved and rather flat.

PHALARIS.—The grain of *P. canariensis* is the ordinary canary seed of the bird-fancier.

PHLEUM.—The seeds of all the species are very similar to those of timothy.

POA.—The palea of *P. aquatica* is dark green, the inner palea is punctate, the rachilla is cylindrical and slender, and the grain is dark brown. The palea of *P. fluitans* is very rough, the seed is long and slender, and the grain ovate. The seed of *P. maritima* is angular, small, and brown, and so is that of *P. distans* and of several of the other species. In *P. annua* the ribs of the palea are silky and strongly marked, and there is no web. The palea in *P. alpina* is acute, compressed, keeled, with hairy ribs and nerved tips; the grain is triangular, slender, and the ventral surface is concave.

PSAMMA.—The seed of marram is three-eighths of an inch in length, linear-lanceolate in shape, and ivory white in colour, with a tuft of hairs at the base ; the grain is brown and grooved.

SESLERIA.—The palea of *S. cærulea* is mucronate and serrulate, and the seed is oblong and greyish yellow.

TRIODIA.—In *T. decumbens* the central tooth of the palea is characteristic, and a further distinction is the hairy base.

An attempt at a tabular scheme by which all our hundred and one species can be recognised by their seeds is, let us say, a task not to be lightly undertaken; but the following key to the identification of those of the chief pasture grasses—and their most frequent associates—deals with the varieties for quickly distinguishing which some short method is likely to be useful.

Seed awnless.
- Grain without a groove.
  - Grain free or with palea only, small and ovoid-acute. *Phleum pratense.*
  - Grain not free.
    - Hilum linear and long.
      - Grain broader at apex than at base. *Festuca ovina.*
      - Grain not broader at apex than at base. *Digraphis arundinacea.*
    - Hilum linear and short. *Dactylis glomerata.*
    - Hilum round, seed angular.
      - Palea pointed. *Poa pratensis.*
      - Palea blunt. *Poa nemoralis.*
- Grain with a groove.
  - Grain broader at apex than at base.
    - Hilum linear and long.
      - Colour grey. *Festuca elatior.*
      - Colour whitish yellow. *Festuca pratensis.*
  - Grain not broader at apex than at base.
    - Seeds rounded.
      - Rachilla obsolete ; seed small. *Agrostis stolonifera.*
      - Rachilla short, flat, angular. *Lolium perenne.*
      - Rachilla short, smooth, dilated above. *Cynosurus cristatus.*
      - Rachilla stout and hairy. *Elymus arenarius.*

Seeds angular.
Grain rounded at both ends. *Poa trivialis.*
Grain pointed. *Poa alpina.*

Seed awned.

Grain without a groove.
Seed, the chestnut brown spikelet less the glumes. *Anthoxanthum odoratum.*
Awn bent; grain with traces of stigma; spikelet silvery grey. *Alopecurus pratensis.*
Awn long, smooth, and stiff; grain purple, with traces of stigma. *Bromus erectus.*
Awn smooth; grain reddish. *Bromus asper.*
Awn rising between two teeth; rachilla bent. *Bromus mollis.*
Awn twisted closely with pale spiral band. *Arrhenatherum avenaceum.*

Grain with a groove.
Grain broader at apex than at base.
Rachilla smooth.
Grain light grey. *Festuca duriuscula.*
Grain greyish brown. *Festuca rubra.*
Rachilla downy.
Grain dark grey. *Festuca heterophylla.*

Grain not broader at apex than at base.
Awn kneed; rachilla flat, with white hairs. *Avena flavescens.*
Awn curved; grain hairy at apex. *Holcus lanatus.*
Awn straight; grain white; rachilla hairy. *Aira cæspitosa.*
Awn twisted loosely; grain dark; rachilla hairy. *Aira flexuosa.*
Awn hairy and long; rachilla smooth and stout. *Brachypodium sylvaticum.*
Awn serrulate; rachilla serrulate. *Hordeum murinum.*

CHAPTER X.

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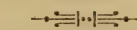

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